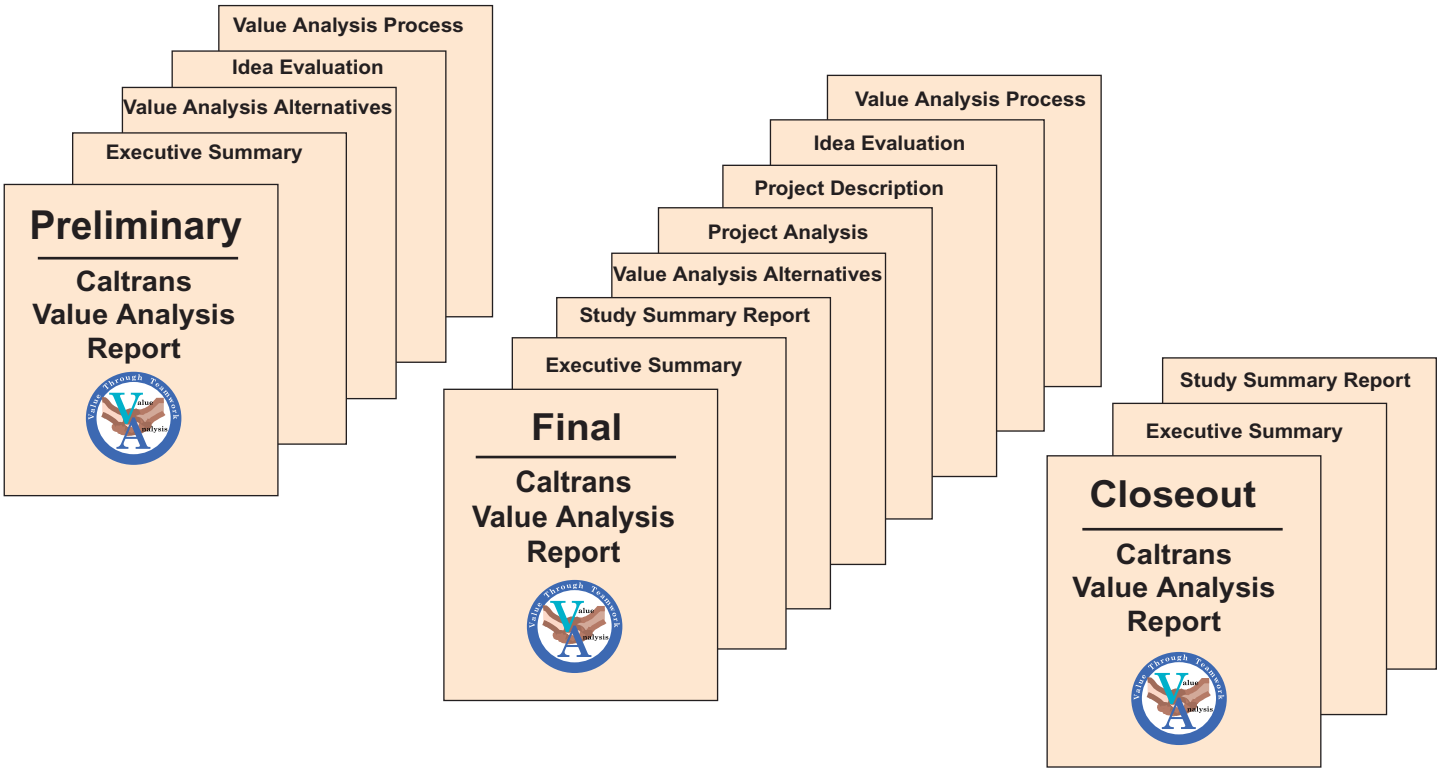
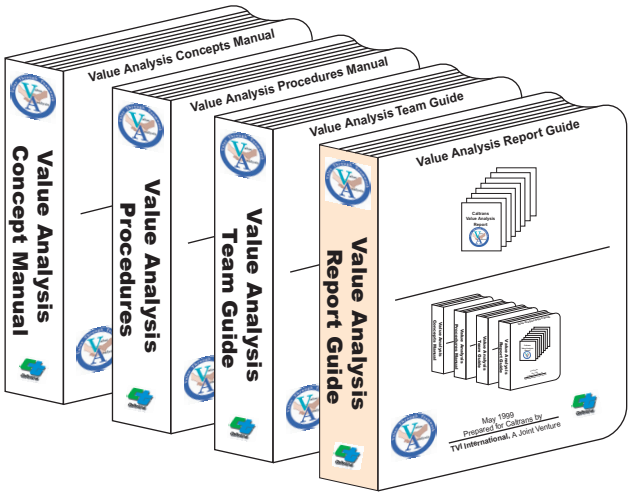
Value Analysis Report Guide





Third Edition
April 2003

State of California Department of Transportation
Division of Design
Value Analysis Branch

Prepared for Caltrans by

VMS
Value Management Strategies, Inc.

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: District Value Analysis (VA) Coordinators **Date:** April 1, 2003

File: 303

From: **DEPARTMENT OF TRANSPORTATION**
Division of Design
Mail Stop #28

Subject: VA Team Guide / VA Report Guide

The VA Branch is pleased to send you the Third Edition of the Team Guide and Report Guide. These guides document Caltrans' VA Study requirements. Please share these guides with interested District personnel and make them available to team members during VA Studies.

The purposes of these manuals are as follows:

> **VA Team Guide:** Assists the VA Study participants in employing the Caltrans VA Study methodology over the course of the VA Study. The VA Team Guide includes all of the forms, with instructions, needed to document the VA team activities and the individual VA alternatives. The Third Edition expands on the Caltrans project performance measures, and provides more detail on the study initiation activities and the implementation activities of the VA Study.
>
> **VA Report Guide:** The Report Guide outlines the Caltrans VA Study Report requirements for the VA report writer, including instructions and examples. The Third Edition separates and details the Preliminary Report and the Final Report.

If you have any questions, please call me at 916-653-3538 (CALNET 453-3538).

Sincerely,

GEORGE HUNTER, PE, CVS
Chief, Value Analysis Branch

FOREWORD

It is Caltrans' policy to apply Value Analysis (VA) in all functional areas, including project development, construction, traffic, operations and maintenance.

This VA Report Guide is a tool to carry out that policy. It is primarily for use by the VA Team Leader. The Report Guide serves as a reference document for the VA methodology and as a detailed guide to the preparation of the documentation needed to report the results of a VA Study.

Each section of this Report Guide describes the steps to incorporate the preprinted forms used during the VA Study (specific instructions for completion of the forms are included in the VA Team Guide). The Report Guide organizes all of the documentation to compile a clear and concise report that will communicate the findings of the VA Study and facilitate implementation of the VA alternatives. This guide serves as a model for a "standard" VA report; modifications may be made to accommodate special circumstances in VA studies.

All pages in this guide printed in Italics are specific instructions for the example documents on following pages.

Divider pages with tabs identify the sections of the standard report format.

VA Report Checklists are included to use as a guide while preparing a report.

Caltrans Value Analysis Reference Documents **Modified April 2003**			
		REFERENCE DOCUMENT	
Topic	**Item**	**VA Team Guide**	**VA Report Guide**
	Primary Users	Team Leaders and Team Members	Team Leaders
	Function	Execute Caltrans VA Study Methodology	Document VA Study Results
Introduction	Foreword	X	X
	Reference Documents	X	X
	Overview	X	X
	Activity Chart	X	X
Caltrans VA Methodology	Initiate Study	X	
	Organize Study	X	
	Prepare Data	X	
	Inform Team	X	
	Analyze Functions	X	
	Create Ideas	X	
	Evaluate Ideas	X	
	Develop Alternatives	X	
	Critique Alternatives	X	
	Present Alternatives	X	
	Assess Alternatives	X	
	Resolve Alternatives	X	
	Present Results	X	
Report Preparation	Report Organization		X
	Executive Summary		X
	VA Study Summary Report		X
	VA Alternatives		X
	Project Analysis		X
	Project Description		X
	Idea Evaluation		X
	VA Process		X
Close Out Study	Resolve CA Alternatives		X
	Update Executive Summary		X
	Update VA Study Summary Report		X

TABLE OF CONTENTS

FINAL VA STUDY REPORT

VA Program Overview

CALTRANS VA POLICY

The Caltrans Project Development Procedures Manual (PDPM), Chapter 19 – Value Analysis, presents the policy and procedures to apply Value Analysis (VA) to highway construction projects and other activities of the department. The applications, roles and responsibilities, and activities necessary to carry out a VA Study are outlined. In summary, the PDPM covers the following topics in five sections:

1. General Policy, Procedures, and Benefits of Value Analysis
2. Value Analysis Annual Program
3. Roles and Responsibilities of District and Headquarters Personnel
4. Integrating VA and the Project Development Process
5. VA Job Plan and Activities

VA APPLICATIONS

According to the PDPM, the VA process can be equally applied to projects, products (engineering items), and processes as follows:

1. **Highway Construction Projects.** The use of VA to improve the value of projects has been demonstrated in all Caltrans Districts since 1969. Highway VA studies are broken down into two categories:

   - **NHS-Mandated Studies.** Congress signed into legislation Section 303 of the NHS Act, which is elaborated in the Federal Rule (23 CFR Part 627), dated February 14, 1997. The federal rule requires Caltrans to establish a program to assure that VA studies are performed on all federal-aid highway projects on the NHS with a ***total*** estimated cost of $25 million or more. The procedures outlined in the Caltrans VA manuals ensure that VA studies within the Caltrans VA Program are in compliance with the federal mandate for NHS studies.

   - **District-Identified Studies.** The Districts are encouraged to voluntarily identify studies. Some of the criteria that may indicate a need for a study include cost overruns, projects with few alternatives identified, high maintenance cost, controversial projects, projects with difficult construction, operational problems, difficult traffic handling, safety considerations, environmental difficulties, right-of-way concerns, major structures, maintenance, and complex geometrics. In addition, Value Analysis can be used to build consensus among project stakeholders.

   - **VA Studies During Construction.** Projects that have already been awarded may be value analyzed during construction, at the discretion of the contractor, if specified in the construction contract's special provisions, leading to cost reduction incentive proposals.

2. **Product Studies.** The VA methodology can improve the quality of highway products. These are items and systems as described in Caltrans Standard Plans and Specifications. Value Analysis can help identify products that need to be updated due to changing technology, outdated application, or any other changes that affect our standard engineering products. Product studies of modifications to headlight glare screens, concrete barriers, and overhead signs have led to statewide modifications.

3. **Process Studies.** The VA methodology can improve the effectiveness of Caltrans processes, such as policies and procedures and business practices. Process study topics that have benefited from VA studies include workload balancing, project development procedures, intergovernmental reviews, District business plans, information access and distribution, regional strategic traffic operations plans, tort liability claims, maintenance operations, and quality of support services.

CALTRANS VA STUDY ACTIVITY CHART

The VA Activity Chart on the following page summarizes the 15 steps required to successfully complete a VA Study. It begins with *Initiate Study* and ends with *Close Out VA Study*. The activities are grouped in three phases:

- **PREPARATION**
  - **Initiate Study** – Identify study project; define study goals; prepare draft study charter and Task Order Initiation Document.
  - **Organize Study** – Conduct preparation meeting; select team members; finalize study charter and Task Order Initiation Document.
  - **Prepare Data** – Collect and distribute data; prepare cost models; develop LCC model.

- **VA STUDY**

  Segment 1
  - **Inform Team** – Receive designer presentation; develop performance criteria; visit project site.
  - **Analyze Functions –** Identify basic functions and cost drivers; prepare FAST diagram.
  - **Create Ideas –** List a large quantity of alternative ideas; use group/individual brainstorming.
  - **Evaluate Ideas** – Evaluate all ideas against performance criteria; rank all ideas.

  Segment 2
  - **Develop Alternatives** – Develop high-ranked ideas into VA alternatives; measure performance.
  - **Critique Alternatives –** Review of alternatives by VA team and Technical Reviewers to develop and ensure team consensus and technical viability. Develop and rate recommended VA alternative set(s).
  - **Present Alternatives –** Give interim presentation of alternatives; prepare preliminary report.

  Segment 3
  - **Assess Alternatives** – Review alternatives; prepare draft implementation decisions.
  - **Resolve Alternatives** – Resolve dispositions; edit and revise alternatives; summarize results.
  - **Present Results** – Give formal presentation of accepted alternatives.

- **REPORT**

  Following the VA Study, the Team Leader assembles all study documentation into the final report:
  - **Publish Results** – Prepare final VA Study Report; distribute printed and electronic copies.
  - **Close Out VA Study –** Resolve open conditionally accepted VA alternatives and update the Executive Summary and VASSR. Provide final deliverables to the HQ VA Branch.

The VA Study is complete when the VA Study report is issued as a record of the VA team's analysis and development work, and the project development team's implementation dispositions for the alternatives. The VA Activity Chart serves as a guide to the VA Coordinator, the VA team, and the Team Leader, as well as the stakeholders, all of whom are participants in VA Studies.

The VA Team Guide outlines the steps to accomplish the steps necessary for the performance of the VA Study activities (Boxes 4-13). This VA Report Guide focuses on the preliminary and final report preparation that is identified in Present Alternatives (Box 10) and Publish Results (Box 14) activities. It describes how the Team Leader organizes all of the material generated during the study into a VA Study Report.

Caltrans Value Analysis Activity Chart

PREPARATION

INITIATE STUDY — 1
- Identify study project
- Identify study roles and responsibilities
- Define study goals
- Select team leader
- Prepare draft Study Charter

ORGANIZE STUDY — 2
- Conduct Pre-Study Meeting
- Select team members
- Identify stakeholders, decision-makers, and technical reviewers
- Identify data collection
- Select study dates
- Determine study logistics
- Update VA Study Charter

PREPARE DATA — 3
- Collect and distribute data
- Develop construction cost models
- Develop highway user benefit / life cycle cost (LCC) model

VA STUDY

Segment 1

INFORM TEAM — 4
- Review study activities and confirm reviewers
- Present design concept
- Present stakeholders' interests
- Review project issues and objectives
- Identify key functions and performance criteria
- Visit project site

ANALYZE FUNCTIONS — 5
- Analyze project data
- Expand project functions
- Prepare FAST diagram
- Determine functional cost drivers

CREATE IDEAS — 6
- Focus on functions
- List all ideas
- Apply creativity and innovation techniques (group and individual)

EVALUATE IDEAS — 7
- Apply key performance criteria
- Rate idea to key performance criteria
- List advantages and disadvantages
- Consider cost impacts
- Prioritize ideas (1-5)
- Assign alternatives for development

Segment 2

DEVELOP ALTERNATIVES — 8
- Develop alternative concepts
- Prepare sketches and calculations
- Measure performance
- Estimate costs, LCC benefits/costs

CRITIQUE ALTERNATIVES — 9
- VA Alternatives Technical Review
- VA Alternatives Team Consensus Review
- Assign alternative numbers so that mutually exclusive alternatives are apparent
- Identify VA sets
- Validate performance

PRESENT ALTERNATIVES* — 10
- Present findings
- Document feedback
- Confirm pending reviews
- Prepare preliminary report

**Interim presentation of study findings*

Segment 3

ASSESS ALTERNATIVES** — 11
- Review Preliminary Report
- Assess alternatives for project acceptance
- Prepare draft implementation dispositions

***Activities performed by PDT, Technical Reviewers, and Stakeholders*

RESOLVE ALTERNATIVES — 12
- Review implementation dispositions
- Resolve implementation actions with decision-makers and stakeholders
- Edit alternatives
- Revisit rejected alternatives, if needed

PRESENT RESULTS* — 13
- Present results
- Obtain management approval on implemented alternatives
- Summarize performance, cost, and value improvements

**Final presentation of study results*

REPORT

PUBLISH RESULTS — 14
- Document process and study results
- Incorporate all comments and implementation actions
- Distribute Final VA Report
- Distribute electronic report to HQ VA Branch
- Update VA Study Summary Report (VASSR)
- Provide HQ the Final VA Report in pdf format

CLOSE OUT VA STUDY — 15
(if Conditionally Accepted Alternatives exist)
- Resolve Conditionally Accepted Alternatives
- Finalize VA Study Summary Report (VASSR)
- Finalize Performance Measures
- Finalize VA Report Executive Summary and provide electronically to HQ

Note: The dashed boxes indicate steps that ***may*** not be required in some VA Studies.

Preliminary Report Organization

PRELIMINARY VA REPORT CHECKLIST

The following checklist guides the VA Team Leader through all of the items contained in the VA Study Report. It is organized in the order of the printed report. However, it is helpful to complete the items in reverse order so that the Executive Summary is written last, after the balance of the report is completed.

Report Front Material

- ☐ Front Cover
- ☐ Preliminary Instruction Letter
- ☐ Preliminary Value Analysis Study Report Structure and Content
- ☐ VA Alternative Implementation Action Instructions and Example
- ☐ Distribution List
- ☐ Divider Pages
- ☐ Table of Contents

Executive Summary

- ☐ Synopsis
- ☐ Introduction with EA Number(s) and Purpose of VA Study
- ☐ Project Description Summary
- ☐ Project Issues Summary
- ☐ Project Analysis Summary
- ☐ VA Alternatives
- ☐ Performance and Value Improvements
- ☐ Rating Rationale – Proposed Alternatives
- ☐ Performance Rating Matrix – Proposed Alternatives
- ☐ VA Study Participants, Contact Information, and Schedule

VA Alternatives

- ☐ Summary of VA Alternatives
- ☐ Define Performance Rating Criteria and Parameter Scales
- ☐ VA Alternative Documentation

Idea Evaluation

- ☐ Idea Evaluation
- ☐ Idea Evaluation Forms

VA Process

- ☐ VA Process
- ☐ Caltrans Project Performance Measurement
- ☐ Caltrans VA Activity Report
- ☐ VA Study Agenda
- ☐ Meeting Attendees

PRELIMINARY REPORT OUTLINE

The Preliminary VA Study Report is prepared following each study in accordance with the standards outlined in this VA Report Guide. The Team Leader is primarily responsible for gathering the documentation generated during the study and compiling it systematically into a report to the Project Manager within one to two weeks following the study. The VA Team Guide is a companion volume used to facilitate the development of documents prepared by the VA team.

Two VA Study Reports are published: the Preliminary VA Study Report, approximately two weeks after completion of Segment 2 of the VA Study, and the Final VA Study Report, published after completion of Segment 3 (Implementation Meeting).

The VA Study Report is organized in sections, preceded by an instruction letter, distribution list, and Table of Contents. The Preliminary VA Study Report includes:

- **Executive Summary** Provides an overview of the VA Study and the VA alternatives
- **VA Alternatives** Documents the individual VA alternatives
- **Idea Evaluation** Lists all of the creative ideas and their evaluations
- **VA Process** Summarizes the VA process, schedule, and participants

Preparing a thorough Preliminary VA Study Report is essential to clearly communicate the VA alternatives to the stakeholders and designer as the first step in their implementation.

The report is a transcription of the handwritten work of the VA team members; it is kept in electronic and hard copies.

The purpose of the Preliminary Report is to provide documentation of the VA alternatives to the reviewers in order to get their response to the viability and acceptability of these alternatives. For that reason, it is limited to the sections noted above. It has been determined that, in most cases, the added sections that are contained in the Final Report are important for the ultimate documentation of the study, but they are not imperative for the review and disposition of the VA alternatives.

During the Pre-Study meeting the Preliminary and Final Report content are discussed, and if the District or external stakeholders want additional sections to be included in the Preliminary Report, the Team Leader will make those adjustments.

PRINTING AND BINDING

The VA Study report is printed one-sided to accommodate the variety of technical information included in the VA alternatives.

The Preliminary VA Study Report is bound with metal fasteners *(ACCO metal binders No. ACC-70723 are recommended)*. *These are working copies and are not to be comb bound, spiral bound, or placed in a binder.* The cover will be black and white and marked "Preliminary." Colored divider sheets are to be used to separate the sections. This report is intended to be a review and comment copy (a working document).

Cover Page. *The example cover page for the report includes:*

- ***Front Cover*** *– Standardized format prepared by the reporting organization, to identify study project, including project EA numbers.*

Value Analysis Study Report

SR 64 Widening
South Paseo, California

13-3917U0-NCA-64-KP 51.8/80.8 (Western Section)
13-39580K -NCA-64-KP 80.8/90.0 (Eastern Section)

Contract No. 53A0020
Task Order No. 115

June 2000

Prepared by

VMS
Value Management Strategies Inc

PRELIMINARY INSTRUCTION LETTER

An instruction letter and distribution list accompany the Preliminary VA Study Report, identifying the study project, what is expected of the reader, and specifying the names and/or departments receiving the report.

Preliminary Instruction Letter. *The preliminary instruction letter is a formal transmittal of the draft report to all recipients. It introduces the study project, requests a review of the VA alternatives, and instructs the reader on how to submit his/her comments. The cover letter should also note any VA alternatives that require special attention by specific reviewers to ensure that they are properly addressed during the review period.*

Preliminary Value Analysis Study Report Structure and Content. *This provides the report reviewer an understanding of the content and organization of the Preliminary VA Report to help facilitate the review of the report and resolution of the alternatives.*

Specific instructions for completion of the VA Alternative Implementation Action form are included following the instruction letter.

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: **All Recipients of Preliminary Value Analysis Report for SR 64 Widening Project**

Date: June 15, 2000
File: 303

From: **DEPARTMENT OF TRANSPORTATION**
Design and Local Programs
Mail Stop #28

The VA Branch is pleased to submit this Preliminary Value Analysis Study Report for the referenced project. Following this cover letter is an overview of the report structure and content to assist the reader to understand how the report is organized, and to better facilitate the review process.

This report summarizes the results and events of the study conducted June 13-15 and June 20-22, 2000, in South Paseo, California.

DECISION-MAKERS PLEASE NOTE: at the VA Implementation Meeting scheduled for _____, you will be asked to accept, conditionally accept, or reject each VA alternative included in this report. In addition, you will be asked to agree or disagree with the cost savings and performance measures ratings the VA team applied to each VA alternative that is accepted or conditionally accepted.

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition, the cost changes, and performance changes for the alternative is required by Caltrans to ensure that the project decision makers agree with the study results. Furthermore, these validated results become the basis for the VA Program reportables.

The VA process is complete only when the implementation decisions for every VA alternative have been received from the Project Manager and documented in the VA Report. The Assess Alternatives and Resolve Alternatives activities provide the VA team, the Project Manager, and District/Region management the assurance that the alternatives are properly evaluated and the implementation decisions are based on the merit of the alternative. This process helps to eliminate inaccurate study alternatives and legitimizes the results of the study and the VA Program.

Please use the VA Alternative Implementation Action forms at the end of each VA alternative to provide your comments. Instructions for completing this form and an example completed form are included on the following pages. **Please complete your review of the VA alternatives and provide your written comments no later than July 28 to**:

Wendy O'Mally
Fax 805-555-3480 or E-Mail Wendy_O'Mally@dot.ca.gov

Alternative 3.1, as proposed, would require a design exception. We request that the HQ Design Reviewers provide their comments on at least this VA alternative, as it will be key to the decision-making process.

During the Implementation Meeting, we will review the individual VA Implementation Action form responses, develop a consensus for each VA alternative, document the responses to each alternative, and conclude decisions related to implementation. After that meeting, we will integrate the results into the Final Value Analysis Study Report.

It was a pleasure working with District 13 on this project, and I look forward to continuing our efforts on the next one.

Sincerely,

INSTRUCTIONS FOR COMPLETING VA ALTERNATIVE IMPLEMENTATION ACTION FORM

The VA Alternative Implementation Action form should be completed by the Caltrans project development team, the Caltrans technical reviewers, and the project stakeholders, as they review the Preliminary VA Study Report.

The information on this form is used to guide the project stakeholders and decision makers as they determine the ultimate disposition of each VA alternative.

VA Alternative Implementation Action. *The VA Alternative Implementation Action form should be completed according to the following instructions:*

- ***Responses:***
  - ***Prepared by –*** *Identify who is preparing the response*
  - ***Technical Feasibility/Validated Performance –*** *Agree/disagree with the technical feasibility of the alternative based on project-specific criteria, and record agreement/disagreement with initial performance ratings*
  - ***Implementable Portions –*** *If the VA Alternative is not implementable in its entirety, identify portions of the alternative that may be selectively implemented.*
  - ***Validated Cost Savings –*** *Agree/disagree with the estimated cost savings; substantiate revised implemented savings*
  - ***Project Development Support Cost Savings*** *– Savings (increases) to project development costs resulting from the VA alternative. This can be due to reduced (or increased) design effort needed, or an earlier project delivery date.*
  - ***Project Development Delivery Impact –*** *Check boxes to designate if the alternative has no change to the project delivery phase, or indicate the person months saved or increased for each phase. Discuss the areas in which these schedules will be impacted.*
  - ***Other Comments –*** *Comment on other issues not addressed in the alternative. Note any concerns or controversial items.*
- ***Implementation Disposition*** *– Choose one of the following dispositions:*
  - ***Accept*** *– Acceptance of the alternative denotes intent to implement in the given project development phase.*
  - ***Conditionally Accept*** *– Alternative is desired but requires added technical analysis and/or stakeholder agreement before final disposition can be made.*
  - ***Reject –*** *Alternative is not acceptable as presented. For rejected alternatives, check the appropriate box to note whether or not rejection is due to the fact that the VA Study took place too late in the Project Development Process.*
- ***Validated Performance*** *– Validated performance.*
- ***Validated Savings*** *– Validated cost savings in dollars.*

At the Implementation Meeting, all comments will be reviewed and consensus determined for the disposition of each alternative. Timing of these responses is critical, as added delays in responding could adversely impact the project delivery schedule.

VA ALTERNATIVE IMPLEMENTATION ACTION (PRELIMINARY) ***Example Project***		**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange		**NUMBER** 8.0
RESPONSES	**Prepared by:** Joe Q. Reviewer	**Date:** 07/27/00

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance:

The undercrossing concept is feasible and will be implemented in the PR&ED. The westbound off-ramp will be studied further to determine if a conventional diamond can be used at this location.

The construction of an interchange might have a greater impact on the project than indicated by the VA team; I suggest reducing the performance rating by one point each for Constructibility, Environmental Impacts, and Right-of-Way Impacts.

DISPOSITION

☑ **Accept**

☐ **Conditionally Accept**

☐ **Reject**

Validated Performance
+12%

Implementable Portions:

The concept can be implemented in full. The bridge cost for the Olive Hill Undercrossing will have to be verified by Structures in an Advance Planning Study.

If Alternative is Rejected

Was rejection due to VA Study taking place too late in the project development process to implement the change?

Yes ☐ No ☐

Validated Cost Savings:

The bridge design as shown in this VA Study will be reviewed as part of the APS to determine whether the $2.0 million increase is sufficient. At this time the cost assumptions and cost estimate appear reasonable.

Significant operational benefits result from this alternative. However, with this improvement, demand would probably be increased in this area ~5% as well. As a result, the highway user benefits savings projected by the VA team of $34,200,000 may be slightly higher than expected. My calculations show the operational improvements of ~$29,700,000 to be more reasonable.

Validated Savings
($2,000,000) Initial
$29,700,000 LCC

Project Development Support Cost Savings

($170,000)

Project Development Delivery Impact:

This alternative will add Structures design work and project development costs for this new structure. The PA&ED phase will be extended to get the geotechnical information necessary for Structures and address visual impacts in the Environmental Document.

	No Change	Reduced by	Increased by
PID	☑	Mo.	Mo.
PA&ED	☐	Mo.	2 Mo.
PS&E	☑	Mo.	Mo.
Const.	☑	Mo.	Mo.

Other Comments:

HQ has provided verbal approval of this concept due to the significant operational benefits it provides, but has requested that we study the full diamond interchange possibility further to see what it would take to make it work.

Preliminary Value Analysis Study Report Structure and Content

PURPOSE OF REPORT

The Preliminary VA Study Report is a working document, circulated to interested parties to provide them an opportunity to comment on the VA team's findings. This report does not include supporting details of all of the team's activities. Rather, its contents are intended to provoke responses to the VA alternatives, so that all of the stakeholders' interests are considered before implementation decisions are reached.

A GUIDE TO READING THIS REPORT

The Preliminary VA Study Report includes:

- **Instruction Letter** Provides instructions to the reader for reviewing and commenting on the VA alternatives.
- **Distribution List** Lists all recipients of the Preliminary Report
- **Executive Summary** Provides an overview of the VA study and the VA alternatives
- **VA Alternatives** Documents the individual VA alternatives, which suggest modifications to current design concepts.
- **Idea Evaluation** Lists all of the creative ideas and their evaluations
- **VA Process** Describes the VA methodology employed by Caltrans. The VA study schedule and participants are also included in this section.

The **Instruction Letter** provides important information to the reader about how to comment on the VA alternatives, including to whom and by when the comments should be submitted. Specific instructions for, and an example of, a completed "Implementation Action" form are included with the letter.

The **Distribution List** is provided to enable collaboration among reviewers when compiling comments on the VA alternatives.

The first page of the **Executive Summary** provides a "Synopsis", a *very brief* summary of the VA study and results. The Executive Summary itself elaborates on the Synopsis, providing brief descriptions of the project, issues associated with the project, the tools used by the VA team to analyze the project, and a summary of the VA alternatives produced. Performance ratings developed by the VA team for selected groups of VA alternatives are presented along with the rationale for those ratings. Finally, the VA team is acknowledged in the Executive Summary. *Note that all of the information summarized in the Executive Summary is elaborated upon in the Final VA Study Report. This supporting information is not included in the Preliminary Report, to enable the reviewers to better focus on the information that is essential to their decision process.*

VA Alternatives are presented in detail, with sketches, performance measures, assumptions and calculations, and cost estimates. Each VA alternative includes an "Implementation Action" form (discussed in the Instruction Letter at the front of the report) for the reader's use in responding to the VA alternative. The VA Alternatives section of the report also includes definitions of performance criteria and rating scales used by the VA team to develop the Performance Measures form for each VA alternative. *This information is intended to help the reader determine whether they agree or disagree with the team's ratings, and make changes accordingly.*

The **Idea Evaluation** list is provided so the reader may see all of the ideas generated by the VA team, how each idea was evaluated and ranked, and understand why certain ideas were not developed.

The **VA Process** section is included primarily to provide the reader with added information to help them understand how the performance measures are developed and their role in the VA process. The Meeting Attendees list is also provided for the reader's convenience if they wish to contact anyone involved in the VA study.

This Preliminary VA Report is a tool—a stepping-stone in the VA process along the path to finalizing the VA study results. The reader's responses to this preliminary report will be used to refine and improve the information presented by the VA team, and to guide implementation decisions, all of which will be documented in the Final VA Study Report published at the conclusion of the VA study.

Definitions of **Key Terms** used in VA Study Reports are listed below:

Original Concept is the design solution that is used as the baseline for the VA Study. This can be either one of the PSR, PSSR alternatives or the PS&E design, depending on the point in time that the VA Study is being performed. The VA analysis, proposed changes, and cost and performance potential changes are all referenced against the original concept.

VA Alternative(s) are developed by the VA team as items to be considered as alternatives to either replace or enhance elements of the original concept.

Performance Measurement is a unique methodology developed by the Caltrans VA Program to measure the effectiveness of the project scope of various alternatives. This permits the interrelationship between cost and performance to be quantified and compared in terms of how they contribute to overall value.

Value Analysis Study Summary Report (VASSR) is a seven-page form, structured for database input and used by the Caltrans VA Program Administrators for auditing and reporting purposes. The VASSR includes key project information and documents cost and performance changes for each alternative and set that is proposed, accepted, and conditionally accepted. The study reportable statistics results are also summarized in this document.

Initial Cost refers to the costs for construction, right-of-way, and support that are expended to complete the project and have it open to traffic.

Subsequent Cost refers to operations, maintenance, and other costs that are necessary to keep the facility functioning over the projected life of the project. Typically, a 20-year life is used for life cycle cost comparisons, but when structures are involved, a 50-year life expectancy is used.

Highway User Costs refer to the cost associated with the use of the facility. This includes trip time, energy costs, and accident costs. When alternatives impact one of these factors, the Highway User Cost can be calculated to quantify the differences between alternatives.

Life Cycle Costs consider all costs estimated for a facility over a designated time period (typically either 20 or 50 years) and adjusts those costs to today's dollars, so that alternatives that have different subsequent and highway user costs can be compared, to assist in determining the most cost effective solution for the project.

PID, PA&ED, and PS&E

The Project Initiation Document (PID) phase, Project Approval & Environmental Document (PA&ED) phase, and Plans Specifications and Estimate (PS&E) phase, are the three key design related Caltrans project delivery phases.

PID is often referred to as the "K"-Phase and includes activities to develop documents that define projects (PSR – Project Study Report and PSSR – Project Scope Summary Report), and it is required to be developed and approved before any project can be programmed and constructed on the State Highway System. Note: the PSSR is a document that satisfies the requirements for both the Project Study Report (PSR) and the Project Report (PR). It is typically used to program and approve pavement rehabilitation and seismic retrofit projects.

PA&ED is also referred to as the "0"-Phase and includes activities required to obtain project approval. The PA&ED includes activities such as Technical Studies, Draft Project Report (DPR), Project Report (PR), and Environmental Document (ED). It ends with project approval by the District Director and a ROD (Record of Decision) by the FHWA.

PS&E is also referred to as the "1"-Phase and includes those activities necessary to develop the project Plans, Specifications, and Estimates that form the basis of the contract documents that lead to a bid and award to the successful contractor.

DISTRIBUTION LIST

The distribution list accompanies the instruction letter and identifies each recipient of the VA Study Report.

Distribution List. *The distribution list directs Preliminary VA Study Reports to all or some of the following, as appropriate for the project:*

- *Project Design Team*
- *Functional Units*
- *Caltrans VA Team Members*
- *VA Coordinator*
- *District Management*
- *Consultant Team Members*
- *Headquarters VA Branch*
- *Local Agencies*
- *Any Other Interested Parties*

VA Study Report

Example Project

Distribution List

VA Team – Caltrans D-13 (5 Copies)

1. Terry Hodges
2. Jeff West
3. Mark Creveling
4. Wendy Weldon
5. Mike Ireland

VA Team – Non-Caltrans (4 Copies)

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2. Mary E. Campbell, Fix 64 Committee*
3. Meg Williams, City of South Paseo *
4. Steve Dennison, COG*

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3. Richard Rosella Project Engineer – Phase 3
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1. Simon Vector, Director
2. Gregg Sampson, Transportation Planning
3. Steve Price, Traffic Operations
4. Pat Connelly, Construction
5. John Majors, Right-of-Way
6. Jorge Granola, Design

Headquarters VA Branch (1 Copy)

1. Earl Burgess*

*Distributed by Value Management Strategies, Inc.

TABLE OF CONTENTS

The Table of Contents tabulates all of the material in the report by major section and subsections. An example of the preliminary reports is shown on the following page.

> ***Table of Contents.*** *The example Table of Contents lists all report sections and sub-sections contained in the report in the sequence presented. No page numbers are given because the VA alternatives are individually paginated; however, each section of text is page numbered.*

> *Note: In order to maintain section numbering consistently, the Table of Contents for the Preliminary Report lists some sections as "To Be Included in Final Report"*

TABLE OF CONTENTS

PRELIMINARY

Executive Summary – Preliminary

SYNOPSIS – PRELIMINARY

The Preliminary Synopsis is a brief, half-page summary of the project scope and cost, and the VA team's recommended alternatives. It allows the reader to understand the study project and the technical scope and potential savings of the VA alternatives. It presents a forward-looking view of the alternatives and their potential impact on the project.

A well-written synopsis is not a "cut and paste" of other report material, but rather a careful rewording of the salient features of the VA report.

Preliminary Synopsis. *The example Preliminary Synopsis includes:*

- ***Project Description*** *– One or two sentences summarizing project scope and cost.*
- ***VA Alternatives*** *– Summary of the key alternatives the VA team felt had the most potential to improve project value. VA alternatives are grouped into "sets" of alternatives. The purpose of these sets is to help the decision makers understand how the various alternatives may be packaged into implementable solutions. For each set, list the alternatives by number. Include a total performance, cost, and value improvement for the sets. Distinguish between initial cost and life cycle cost savings.*

SYNOPSIS

PRELIMINARY

The proposed project consists of widening State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers.

This project is divided into two segments: Western and Eastern. The total cost of these segments is approximately $235,600,000. The VA team identified several VA alternatives that consider modified intersections, median width, roadway alignment, drainage, and the SR 14/SR 64 Interchange. The most significant VA alternatives recommended reducing the design speed in certain areas of the project.

Two groups of alternatives were combined for consideration by the decision makers:

VA Set No.	VA Alternatives	Cost Savings Initial / *Highway User*	Performance Change	Value Improvement
VA Set 1 – Reduce design speed to 110 kph in specific areas	1.2, 2.1, 2.2, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0	($1,982,000) *$42,296,000*	+26%	+52%
VA Set 2 – Reduce design speed to 120 kph in specific areas	1.2, 2.1, 2.2, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0	($1,982,000) *$45,740,000*	+24%	+52%

EXECUTIVE SUMMARY – PRELIMINARY

The Preliminary Executive Summary is a concise overview of the VA Study process and results. It is divided into eight headings and focuses on the major issues for the project and the significant alternatives developed by the VA team. It is short enough to allow easy reader comprehension, but long enough to present a comprehensive summary of the key findings of the VA Study. A well-written Executive Summary makes use of other report material that has been carefully edited to present the most important aspects of the VA Study.

The example Preliminary Executive Summary models the reporting of an overview of the VA process and the results of the study.

Introduction. *The opening paragraph briefly summarizes the scope of the VA Study:*

- ***Project Identification*** *– Project Name and Expense Authorization (EA) numbers:*

13	-	*006051*	-	*NCA*	-	*64*	-	*KP 38.5/39.9*
(District)		*(EA)*		*(County)*		*(Route)*		*(KP)*

- ***Purpose of Study*** *– Identify the reason that the VA Study is being performed (i.e., NHS requirement, to address a specific problem, gain stakeholders' concurrence, etc.)*

Project Description. *The project description is condensed to a single paragraph:*

- ***Project Scope*** *– Essential features; highways, structures, right-of-way*
- ***Project Schedule*** *– Programmed completion dates*
- ***Project Cost*** *– Estimated construction cost, including right-of-way and utilities*

Project Issues. *The significant project concerns and objectives that guided the VA Study are stated concisely:*

- ***Stakeholders' Objectives for the VA Study*** *– Targets of opportunity for VA team*
- ***Designer's Concerns about the Project*** *– Unresolved issues for VA team consideration*
- ***VA Team's Concerns about the Project*** *– From their initial review of the project information provided*

Project Analysis. *A summary of the results gained from the use of the value analysis techniques on the project: Describe what was learned from the analysis that influenced the study and alternatives developed. Discuss only those techniques that impacted the VA Study.*

- ***Cost Model*** *– High cost elements*
- ***Function Analysis / FAST Diagram*** *– Basic functions*
- ***Cost Function Analysis*** *– Cost drivers*
- ***Performance Criteria Matrix*** *– Weighted performance criteria*
- ***Performance Rating Matrix*** *– Value ratios of competing alternatives*
- ***Highway User Life Cycle Benefit-Cost Analysis*** *– Benefit/cost ratio*

VA Alternatives. *The most significant VA alternatives identified by the VA team as having the highest likelihood of improving the project are summarized in short paragraphs:*

- ***Number and Title***
- ***Brief Description –*** *Clearly describe the VA alternative and the rationale for supporting the implementation of this alternative.*
- ***Potential Cost Savings / Subsequent Costs*** *– Potential initial cost savings. If appropriate, enter subsequent cost savings below (in Italics): Life Cycle Cost Savings, Highway User Cost Savings*
- ***Potential Performance Improvement***
- ***Set Development –*** *Discuss the grouping of alternatives into sets, the theme of each set, and the rationale for each set.*

Rating Rationale – Proposed Sets. *Summary of why the VA alternatives or sets were rated differently than the baseline project.*

Performance and Value Improvements. *Brief summary of the Performance Rating Matrix and how it was used, followed by the matrix itself.*

VA Team and Process. *Insert the Participants and Schedule page of the VA Study Summary Report, which includes the following:*

- ***VA Study Participants*** *– VA team and other participants involved in the VA Study*
- ***VA Study Schedule*** *– Schedule of key events and location*

EXECUTIVE SUMMARY

PRELIMINARY

INTRODUCTION

This Value Analysis (VA) Report summarizes the events of the VA Study conducted by Caltrans District 13 and facilitated by Value Management Strategies, Inc. The subject of the study was the SR 64 Road Widening in San Luis Obispo County, California:

- 13-3917U0-NCA-64-KP 51.8/80.8 (Western Section)
- 13-39580K-NCA-64-KP 80.8/90.0 (Eastern Section)

The VA Study was intended to focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders.

PROJECT DESCRIPTION

The proposed project will widen State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. The Western Section is funded through construction, and the Eastern section is funded through the environmental process. The current estimate of $235,600,000 for the total project significantly exceeds available funding.

PROJECT ISSUES

The following are some of the issues and concerns associated with the widening project:

- Approximately 80% of excavation in the Western Section is in a one-mile segment at the Solitude Grade.
- Chandler Creek crosses the roadway several times in the Western Section.
- A roadside rest in the Western Section will require overcrossings or an interchange, unless another rest area is constructed on the opposite side of the highway.
- The Eastern section must deal with significant utility relocations, including oil pipelines.
- The interchange at SR 14/SR 64 must avoid wetlands to the south and east, and the San Andreas Fault to the west.
- Design exceptions will be required in select areas to be able to use a design speed lower than 130 km/h.
- Environmental impacts include vernal pools, wetlands, wildlife habitats, potential for hazardous waste, and some historic considerations.

PROJECT ANALYSIS

The VA team analyzed the project using the Value Analysis tools and job plan.

Using function analysis and Function Analysis System Technique (FAST) diagramming, the team defined the basic function of this project as *Improve Safety*. Key secondary functions include *Separate Traffic, Accommodate Speed Differential,* and *Improve Sight Distance.* Analysis of the functions intended to be performed by the project helped the team focus on the purpose and need of the project and, consequently, how to craft alternative concepts that would provide the required functions.

Specific performance criteria were developed in cooperation with the designers and stakeholders. These criteria were weighted, using a paired comparison approach, which resulted in the criteria used to evaluate ideas and alternative concepts. These criteria are identified later in this section under the heading Performance and Value Improvement.

Approximately 60% of the estimated project costs are for earthwork and structural section work; almost half of those costs are contained in the Western Section. Structures account for more than 20% of the project cost. Rising costs of asphalt and excavation work contribute significantly to the difference between the current project estimates and those contained in the original PSR documents for the Western Section.

Based on the current project estimates, the Highway User Benefit Cost Models show payback periods of seven years for the Western Section, and five years for the Eastern section. The model will be applied to several other VA alternatives and included in the Final VA Study Report.

VA ALTERNATIVES

The VA team developed thirteen alternatives for improvement of the project. Most of the alternatives improve cost and maintain functionality; one adds cost while improving functionality of the project. Some of the alternatives will reduce turning conflicts. Several alternatives will reduce excavation and others help to balance the earthwork required. Two alternatives, suggesting a reduced design speed, will shorten the design radius of horizontal curves, and shorten the length of vertical curves, in selected areas of the project.

The VA team developed two "sets" of alternatives to illustrate potential combinations that may be chosen for implementation. The alternatives included in the sets are those deemed by the team to represent the best value when considering the alternatives' impact on project performance and cost. The two sets chosen by the VA team differ only in the design speed suggested, with one reducing the design speed from 130 km/hr to 110 km/h and the other from 130 km/hr to 120 km/hr, in selected areas of the project. These two alternatives are mutually exclusive (i.e., only one may be implemented), but either may be used with all the other alternatives in the sets.

Summary lists of the VA alternatives are in a following report section; descriptions of seven key VA alternatives are given below:

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
1.2	**Realign SR 64 Southbound and Reroute Solitude Road**	($16,383,000)	+3%
	This concept retains the 4% grade in the baseline design, reduces the design speed at horizontal and vertical curves from 130 km/h to 110 km/h, reduces the 18.6-meter median to 13.8 meters, and reroutes Solitude Road under the new Solitude Bridge to Wiley Road. Significant savings may be achieved, but only a slight improvement (1%) in project performance would result from this alternative.		
2.1	**Design Median Width for Projected Traffic Volumes**	$5,097,000	0%
	This concept suggests reducing the median width based on the projected traffic volumes within each of the three project sections. The alternative will reduce earthwork and reduce right-of-way required. Significant savings may be achieved, with a small improvement in project performance.		
2.2	**Reduce Solitude Grade Median to 7 Meters with Concrete Barrier for ~500 Meters**	$1,814,000	0%
	This alternative suggests a reduced median width in a small portion of the project, and still achieves significant savings with little change in project performance. The concept helps to balance earthwork, reduces environmental impacts, and reduces right-of-way requirements.		
3.0	**Steepen Slopes to 1.5:1**	$6,420,000	+5%
	This alternative results in cost savings, as well as a slight improvement in project performance. The concept reduces earthwork, decreases export, and decreases the amount of right-of-way required.		
4.1	**Lower Design Speed to 120 km/h in Specific Areas**	$6,409,000	+1%
	This alternative recommends lowering the design speed to 120 km/h, or varying the speed to 120 km/h at Solitude, Continental, and Chandler Creek. The concept shortens the design radius of horizontal curves and shortens the length of vertical curves, as well as providing greater flexibility in design around obstructions and existing topography. Project performance would be slightly increased, and significant cost savings may be achieved.		
4.2	**Lower Design Speed to 110 km/h in Specific Areas**	$9,853,000	+1%
	This alternative recommends lowering the design speed to 110 km/h, or varying the speed to 110 km/h at Solitude, Continental, and Chandler Creek. The concept shortens the design radius of horizontal curves and shortens the length of vertical curves, as well as providing greater flexibility in design around obstructions and existing topography. Project performance would be slightly increased, and significant cost savings may be achieved.		
7.0	**Eliminate Asphalt Treated Permeable Base and Edge Drains**	$3,170,000	0%
	This concept would replace the 75 mm of ATPB with 75 mm of Class 2 AB, and eliminate the edge drains. The alternative simplifies construction, and eliminates edge drain maintenance.		

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
8.0	**Undercrossing at Olive Hill Road with Interchange**	($1,982,000) *$34,146,000*	+15%

This alternative results in a significant improvement to traffic operations on the mainline by providing grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center, providing good access and visibility. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area.

Additional alternatives developed included:

- Alternative 1.1: Relocate/consolidate/improve at-grade intersections.
- Alternative 1.3: Eliminate Wiley Drive connection.
- Alternative 5.0: Go around the oil refinery; realign roadway to intersect utilities at 90°.
- Alternative 6.1: Relocate the SR 14/SR 64 Interchange beyond the wetlands.
- Alternative 6.2: Design a simple flyover at the SR 14/SR 64 Interchange.

Because of the funding problems, two Cost/Scope Reduction Alternatives were prepared as well. While these alternatives may substantially reduce the capital cost of the overall project, the Highway User Life Cycle/Benefit Cost Models indicate significant degradation of project performance in the areas of travel time savings and accident reductions.

Detailed documentation of all the VA alternatives is in the Value Analysis Alternatives section of this report.

PERFORMANCE AND VALUE IMPROVEMENTS

Performance measures are an integral part of the Caltrans VA Process. It is a tool used to evaluate the project performance when considering specific criteria that has been defined and weighted by the project stakeholders. The criteria are used throughout the study to evaluate and document alternatives, then ultimately to report overall project performance improvement at the conclusion of the study.

Performance measures are a measure of the project scope and clear, concise definitions of performance criteria and parameter scales are critical in making the performance measures credible and quantitative. Providing detailed definitions of the performance measures will prevent overlap between performance measures (See VA Alternatives section for definitions and rating scales used for this project).

The performance measures for the original design and each alternative developed have been rated using the 1 to 10 rating scale developed for each criterion. The rating scales have been selected to allow the rating to be quantifiable. The stakeholders rated the original concept (baseline for VA Study) during the kick-off meeting the first day of the VA Study. The VA team rated the VA alternatives and evaluated the overall project improvement by developing sets of VA alternatives to compare against the original concept. The stakeholders will be asked to validate the performance measure ratings developed by the VA team at the Implementation Meeting for this study.

The rationale for the numerical rating changes for each alternative set is summarized below. The Performance Rating Matrix comparing the VA sets to the baseline concept follows the rationale for change. More detailed information regarding the performance measurement process is included in the VA Process section at the end of this report.

Rating Rationale – Proposed Alternatives

Performance Criteria	VA Set 1 Reduce Design Speed to 110 kph in Selected Areas	VA Set 2 Reduce Design Speed to 120 kph in Selected Areas
Mainline Traffic Operations	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 110 kph should not have any significant impact, as the design speed is still greater than the average operating speed.	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 120 kph should not have any significant impact, as the design speed is still greater than average operating speed.
Highway User Safety	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.
Access	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.
Local Traffic Operations	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.
Constructibility	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.

Environmental Impacts	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.	Reduced cuts slightly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.
Right-of-Way Impacts	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of-way takes. Most building takes and the need for new frontage roads are eliminated.	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of-way takes and about 50% of the building takes.

PERFORMANCE RATING MATRIX - Proposed Alternatives

Example Project

Caltrans

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		VA Set 1									9		216
		VA Set 2									9		216
Highway User Safety	29	Original Concept						6					174
		VA Set 1									9		261
		VA Set 2									9		261
Access	19	Original Concept							7				133
		VA Set 1								8			152
		VA Set 2								8			152
Local Traffic Operations	10	Original Concept							7				70
		VA Set 1								8			80
		VA Set 2								8			80
Constructibility	2	Original Concept							7				14
		VA Set 1								8			16
		VA Set 2								8			16
Environmental Impacts	14	Original Concept						6					84
		VA Set 1								8			112
		VA Set 2							7				98
Right-of-Way Impacts	2	Original Concept					5						10
		VA Set 1								8			16
		VA Set 2							7				14

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
VA Set 1 (Alternatives 1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	853	26%	195.3	4.37	52%
VA Set 2 (Alternatives 1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	837	24%	191.8	4.36	52%

VA STUDY SUMMARY REPORT PARTICIPANTS and SCHEDULE				**Caltrans**
Project Name: *Example Project*				
TEAM LEADERS				
Name	**Organization**	**Discipline/Position**	**Phone/Email**	**Expertise Level ***
Ginger Adams	Value Management Strategies, Inc.	Team Leader	(760) 555-3012	4
VA STUDY TEAM MEMBERS				
Terry Hodges	Caltrans	Traffic Operations	(855) 555-3664	4
Jeff West	Caltrans	Design	(855) 555-3393	4
Mary E. Campbell	Local Transportation Committee	Chairperson	(855) 555-2888	N/A
Meg Williams	City Representative	Planner	(855) 555-3970	N/A
Steve Dennison	Regional Transportation Agency	Planner	(855) 555-4662	N/A
Mike Ireland	Caltrans	Construction	(855) 555-3111	3
Wendy Weldon	Caltrans	Environmental Planning	(855) 555-3118	3
John Majors	Caltrans	Right-of-Way	(855) 555-3002	3
Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	(760) 555-3495	4
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TEAM RESOURCE ADVISORS				
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STUDY TECHNICAL REVIEWERS				
Larry Bonds	Caltrans – District 13	Environmental Planning	(855) 555-3801	4
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PROJECT DECISION MAKERS				
Nevin Samuels	Caltrans – District 13	Traffic	(855) 555-	N/A
Kim Peterson	Caltrans – South Region	Project Development	(855) 555-0971	N/A
Jorge Granola	Caltrans – South Region	Chief - Design II	(855) 555-3860	N/A

VA STUDY SCHEDULE

Meeting	Dates	Times	Location
Pre-Study Meeting	May 23, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 1	June 13-15, 2000	8:00 – 4:00	D-13 Conference Room
Study Briefing (Kick Off) Mtg.	June 13, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 2	June 20-22, 2000	8:00 – 4:00	Embassy Suites
Technical Review Session	June 21, 2000	1:00 – 3:00	Embassy Suites
Presentation (End of Segment 2)	June 21, 2000	1:00 – 3:00	Embassy Suites
Implementation Meeting	August 8-9, 2000	8:00 – 4:00	D-13 Conference Room

*** VA TEAM EXPERTISE LEVELS**

Since VA Studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be mid-level to expert-level in their knowledge, tenure, and overall experience in the referenced discipline. DVACs should contact the appropriate functional managers, well in advance of the study dates, to provide to the VA team individuals with this level of expertise, and begin recruiting for the VA teams. Consequently, DVACs will contact appropriate functional managers well in advance of the Pre-Study Meeting date to ensure the early recruitment of VA team members with the highest level of expertise.

Expertise Level
4- Expert
3- Advanced
2- Mid
1- Low

VA Alternatives

VA ALTERNATIVES

The VA Alternatives section contains the documented VA alternatives, complete with technical and cost back-up information. All of the information is transcribed to improve legibility, facilitate communication of the study results, and enable electronic reports.

VA Alternatives. *The example VA Alternatives section introduces the VA alternatives in four sub-sections:*

- ***Introduction*** *– The results of the study are summarized.*
- ***VA Alternatives*** *– A brief explanation of the content of the alternatives.*
- ***VA Alternative Sets*** *– The design team is alerted to the groupings of VA alternatives by project elements (e.g., roadway, structures) and the mutually exclusive identifiers that help guide the implementation process.*

  Note: Sets chosen by the VA team do not necessarily represent all possible combinations that may be implemented.
- ***Other Considerations*** *– This section is used ONLY IF NEEDED, and includes narrative descriptions of items beneficial to the Project Development Team, such as changes or clarification needed in project documents, errors or omissions, or "design suggestions".*
- ***Performance Parameter Scales*** *– This section describes the rating scales used by the VA team members on the Performance Measures form of the VA alternative. It is important to include the scales here, so the report reader will understand the basis for the ratings used.*

VA ALTERNATIVES

INTRODUCTION

The results of this study are presented as individual alternatives to the original concept.

VA ALTERNATIVES

Each alternative consists of a summary of the original concept, a description of the suggested change, a listing of its advantages and disadvantages, a cost comparison, change in performance, and a brief narrative comparing the original design with the alternative. Sketches, calculations, and performance measure ratings are also presented.

Performance measures are calculated by rating, on a scale of 1 to 10, the overall project against each of the weighted criteria to arrive at a total score (rating times weight, and totals for all criteria added together). The difference between the score for the project with the VA alternative incorporated, and the score for the project baseline concept, is expressed as a percentage.

The cost comparisons reflect a comparable level of detail as in the original estimate. A life cycle benefit-cost analysis for major alternatives is included where appropriate.

VA ALTERNATIVE SETS

VA sets are established by the VA team as their "best value" solutions, based on improved performance, likelihood of implementation, least community impact, cost savings, or any combination of criteria. A VA set may contain one or more alternatives, and each set is typically mutually exclusive of other sets (i.e., implementing VA Set 1 precludes implementation of VA Sets 2 and 3). VA sets are selected alternatives combined from mutually exclusive groups that can compete in whole, or in part, against the original design concept. This requires additional performance rating and totaling of costs for the sets.

The VA team selected two VA sets for this project. Both sets offer the potential to significantly reduce excavation work; simplify construction; reduce horizontal curve radii, thereby improving sight distance; and reduce the number of intersections and associated turning movements on the highway. Both sets suggest reduction in design speed in selected areas of the project, from 130 km/hr to 120 km/hr, or from 130 km/hr to 110 km/hr. Either of these two alternatives will give the designer greater flexibility to design around obstructions (including utilities) and existing topography. The reduction in design speed is consistent with the highway use and designation.

OTHER CONSIDERATIONS

The VA team generated several design suggestions for consideration by the project development team. These items represent ideas that are relatively general in nature, and are listed below.

- Install video speed enforcement equipment and support infrastructure in the baseline design for the length of the corridor. Consider phased installation of the system, with Phase I being infrastructure installation during the highway upgrade, and Phase II being equipment purchase and placement. Pursue grant money from sources like the Office of Traffic Safety, or ITS dollars.

- Consider the use of retaining walls to avoid or reduce encroachment on environmental resources.

- Widen the roadway toward the river for less expensive right-of-way, and drive sheet pile now to contain the creek for the future. Place sheet piling generally parallel to the existing roadway in areas where the Chandler Creek could wash out highway facilities during the life of the roadway.

- Incorporate all ITS in project. Construct a four-lane expressway and install surveillance loops, CCTV, three additional CMSs, and fiber optic communication cable from the SR 14/SR 64 Interchange to an existing communication hub in South Paseo.

- Construct a 3.0-meter outside shoulder, two 3.6-meter lanes, and a 2.5-meter inside lane. Construct a uniform structural section across the entire roadbed. Simplifying construction with a single plane for most of the structural section would offset a portion of the increased structural section costs.

SUMMARY OF VA ALTERNATIVES

At the conclusion of the development phase, the VA team and Team Leader review all alternatives in preparation for their presentation to the stakeholders. The Summary of VA Alternatives form is used to list all of the team results. Alternatives are numbered sequentially (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one may be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives. The VA alternative number is independent of the original idea number.

The VA sets are established by the VA team as their "best value" solutions, based on improved performance, likelihood of implementation, least community impact, most cost savings, or any combination of criteria. A VA set may contain one or more alternatives, and each set is exclusive of other sets (implementing Set 1 eliminates Sets 2, 3, etc.).

*Note: The Summary of VA Sets is included **in the Preliminary Report ONLY**. In the Final Report, the VA Study Summary Report precedes this section and includes summaries of the alternatives that are accepted and conditionally accepted.*

Note: VA Sets identified by the team do not necessarily represent all possible combinations that may be considered.

SUMMARY OF VA ALTERNATIVES *Example Project*		Caltrans	
Number	**Description**	**Potential Savings Initial /** ***Highway User***	**Performance**
1.1	Relocate / Consolidate / Improve At-Grade Intersections	$885,000	+3%
1.2	Realign SR 64 Southbound and Reroute Solitude Road	$16,183,000	+3%
1.3	Eliminate Wiley Drive Connection	$1,700,000	+8%
2.1	Design Median Width for Projected Traffic Volumes	$5,097,000	0%
2.2	Reduce Solitude Grade Median to 7 Meters, with Concrete Barrier for ~1,000 Meters	$1,814,000	0%
3.0	Steepen Slopes to 1.5:1	$6,420,000	+5%
4.1	Lower Design Speed to 120 kph in Selected Areas	$6,409,000	+1%
4.2	Lower Design Speed to 110 kph in Specific Areas	$9,853,000	+1%
5.0	Go Around the Oil Refinery; Realign Roadway to Intersect Utilities at 90º	$1,011,000	+3%
6.1	Relocate 14/64 Interchange Beyond Wetlands	$400,000	+2%
6.2	Design Simple Flyover at 14/64 Interchange	$4,006,000	+4%
7.0	Eliminate asphalt treated permeable base (ATPB) and edge drains	$3,170,000	0%
8.0	Undercrossing at Olive Hill Road with Interchange	($1,982,000) *$34,146,000*	+15%

SUMMARY OF VA SETS

Set No.	Description	Cost Savings Initial / *Highway User*	Change in Performance	Change in Value
1	Reduce design speed to 110 km/hour (1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$42,296,000*	+26%	+52%
2	Reduce design speed to 120 km/hour (1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$45,740,000*	+24%	+52%

DEFINE PERFORMANCE RATING CRITERIA AND PARAMETER SCALES

During development of each VA alternative, the VA team member completes a Performance Measures form to evaluate the overall project with that VA alternative incorporated. For each criterion, the project is rated on a scale of 1 to 10, and multiplied by the criterion's weight.

The Performance Rating Scales identify the 1 to 10 measurements defined by the team. They are included in this section of the Preliminary Report to enable the reader to understand the basis for the team's ratings.

> *Note: The Performance Rating Scales are included **in the VA Alternatives section of the Preliminary Report ONLY**. In the Final Report, the Performance Rating Scales are included in the Project Analysis section of the report.*

Performance Rating Criteria and Parameter Scales

In the course of developing each VA alternative, the team evaluated the effect of the VA alternative on overall project performance (see the Performance Measures form included with each alternative). The rating scales associated with the 1 to 10 ratings used by the team are shown below.

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Mainline Traffic Operations	A measure of the efficiency of traffic operations as they relate directly to the mainline alignment (including on-ramps and off-ramps), based upon a 20-year projected traffic forecast.	10	LOS "A": Volume/Capacity = 0.0–0.30; Free flow – excellent operation
		9	LOS "B": Volume/Capacity = 0.31–0.48; Stable flow – very good operation
		8	LOS "C": Volume/Capacity = 0.49–0.64; Stable flow – good operation
		7	LOS "D": Volume Capacity = 0.65–0.80; Approaching unstable flow – fair operation
		6	LOS "E": Volume/Capacity = 0.81–0.90; Unstable flow – poor operation
		4	LOS "F": Volume/Capacity = 0.91–1.05; Traffic congestion for 15 minutes to 1 hour
		3	LOS "F"; Volume/Capacity = 1.06–1.20; Traffic congestion for 1 to 2 hours
		2	LOS "F": Volume/Capacity = 1.21–1.34; Traffic congestion for 2 to 3 hours
		1	LOS "F": Volume/Capacity = 1.35 or more; Traffic congestion for more than 3 hours

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Highway User Safety	A measure of how the concept will work toward reducing not only the number of accidents, but the severity of accidents, within the project area.	10	
		9	
		8	Concept significantly improves sight distance and horizontal and vertical curve problems. Anticipated accident rate lower than statewide average for similar facility.
		7	
		6	Concept improves sight distance and horizontal and vertical curve problems. Anticipated accident rate comparable to statewide average for similar facility.
		4	
		3	Concept does not improve sight distance and horizontal and vertical curve problems that currently exist.
		2	
		1	

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Access	An approximation of a facility's degree of access (both ingress and egress) between the local roadway infrastructure and the highway system. This criterion considers how well the facility meets driver expectations, the quantity (number of on- and off-ramps), and quality (directness) of access.	10	Optimal access (i.e., all major and minor movements are provided for, and driver expectations for access are fully met)
		9	Excellent access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – one minor movement requires out-of-direction travel)
		8	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – two minor movements require out-of-direction travel)
		7	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – several minor movements require out-of-direction travel)
		6	Satisfactory access (i.e., essentially meets driver expectations; one major movement and one minor movement require out-of-direction travel)
		5	Satisfactory access (i.e., essentially meets driver expectations; several major and minor movements require out-of-direction)
		4	Marginal access (i.e., several major movements require out-of-direction travel – some minor movements are not provided)
		3	Limited access (i.e., multiple major movements are not provided and/or significant out-of-direction travel is required)
		2	Severely limited access (i.e., multiple major movements are not provided and significant out-of-direction travel is required)
		1	Unsatisfactory access (i.e., no access is provided – facility relies upon other interchanges or ramps beyond the scope of the project for access)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Local Traffic Operations	A measure of the efficiency of traffic operations as they relate to the local roadway infrastructure based upon a 20-year projected traffic forecast.	10	Optimal operations (i.e., highest level of service achievable for the facility in question – LOS "A")
		9	
		8	Good operations – traffic delays during peak hours are minimal (i.e., overall level of service equivalent to a "B")
		7	
		6	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service equivalent to a "C")
		5	
		4	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service equivalent to a "D")
		3	
		2	Unsatisfactory operations – major delays during peak hours (i.e., overall level of service equivalent to a "E")
		1	Unacceptable operations – traffic gridlock is the norm (i.e., overall level of service equivalent to a "F")

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Constructibility	A measure of how the concept will affect Caltrans' ability to construct the project, including staging considerations.	10	
		9	Easier to construct than baseline; staging is acceptable (no closures required)
		8	
		7	Not particularly difficult to construct, and staging is acceptable (no closures required)
		6	Slightly degrades ability to stage construction, and some project features more difficult to construct
		5	
		4	Significantly degrades ability to stage construction
		3	Added features will result in more difficult construction and staging
		2	
		1	Cannot be constructed
Environmental Impacts	An approximation of the concept's overall effect on the surrounding environment. This criterion includes the following areas: ◆ Water quality ◆ Land use (such as impacts to parkland and other 4-F resources) ◆ Endangered species (flora and fauna) ◆ Socioeconomic resources (i.e., environmental justice)	10	Major improvement upon existing environmental conditions
		9	Minor improvement upon existing environmental conditions
		8	No environmental impacts
		7	Negligible degradation (i.e., does not require mitigation)
		6	Minor degradation (i.e., requires limited mitigation)
		5	Moderate degradation (i.e., requires significant mitigation in one area or limited mitigation in two)
		4	Moderate degradation (i.e., requires significant mitigation in two areas or limited mitigation in three)
		3	Major degradation (i.e., requires substantial mitigation in one area and limited/ significant mitigation in others)
		2	Major degradation (i.e., requires substantial mitigation in two areas and limited/significant mitigation in others)
		1	Severe degradation (i.e., requires substantial mitigation in multiple areas)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Right-of-Way Impacts	A measure of the amount and types of right-of-way required.	10	No right-of-way required for project
		9	5 or fewer parcels required; none in residential or commercial use
		8	
		7	6-10 parcels required; none in residential or commercial use
		6	
		5	5 or fewer residential and/or commercial parcels required
		4	
		3	6-10 residential and/or commercial parcels required
		2	
		1	Right-of-way difficult or impossible to obtain (e.g., Native American or military owned property)

VA ALTERNATIVE DOCUMENTATION

Each VA alternative is a multi-page write-up of the developed idea or combination of ideas that were highly ranked in the evaluation phase of the study. The documentation includes graphics and calculations, as well as narrative descriptions to communicate the alternative concept without the reader having to refer to outside information. The figure on the following page illustrates the forms that are used and their sequence for a fully developed alternative, including:

♦ **Summary Description**	The original and alternative concepts, advantages and disadvantages, discussion/justification, technical reviewer comments, project management considerations, cost savings, and performance are summarized.
♦ **Sketches**	Graphics for original and alternative concepts.
♦ **Performance Measures**	Summary of non-financial benefits.
♦ **Assumptions and Calculations**	State the assumptions used to determine material quantity or unit cost changes, and show the calculations used to determine the VA alternative quantities or unit costs. The results of these calculations are then used on the Initial Cost worksheet to calculate cost totals.
♦ **Initial Costs**	Estimates of the original and alternative initial costs of project elements affected by the VA alternative.
♦ **Life Cycle Costs**	Total of initial and subsequent costs. These may include annual operational costs, future periodic maintenance costs, and highway user cost impacts.
♦ **VA Team Alternative Review**	VA team review and comments on the alternative.
♦ **VA Alternative Implementation Action**	The Implementation Action forms are completed by the readers of the report during the review and comment period (see pages 2.8 and 2.9).

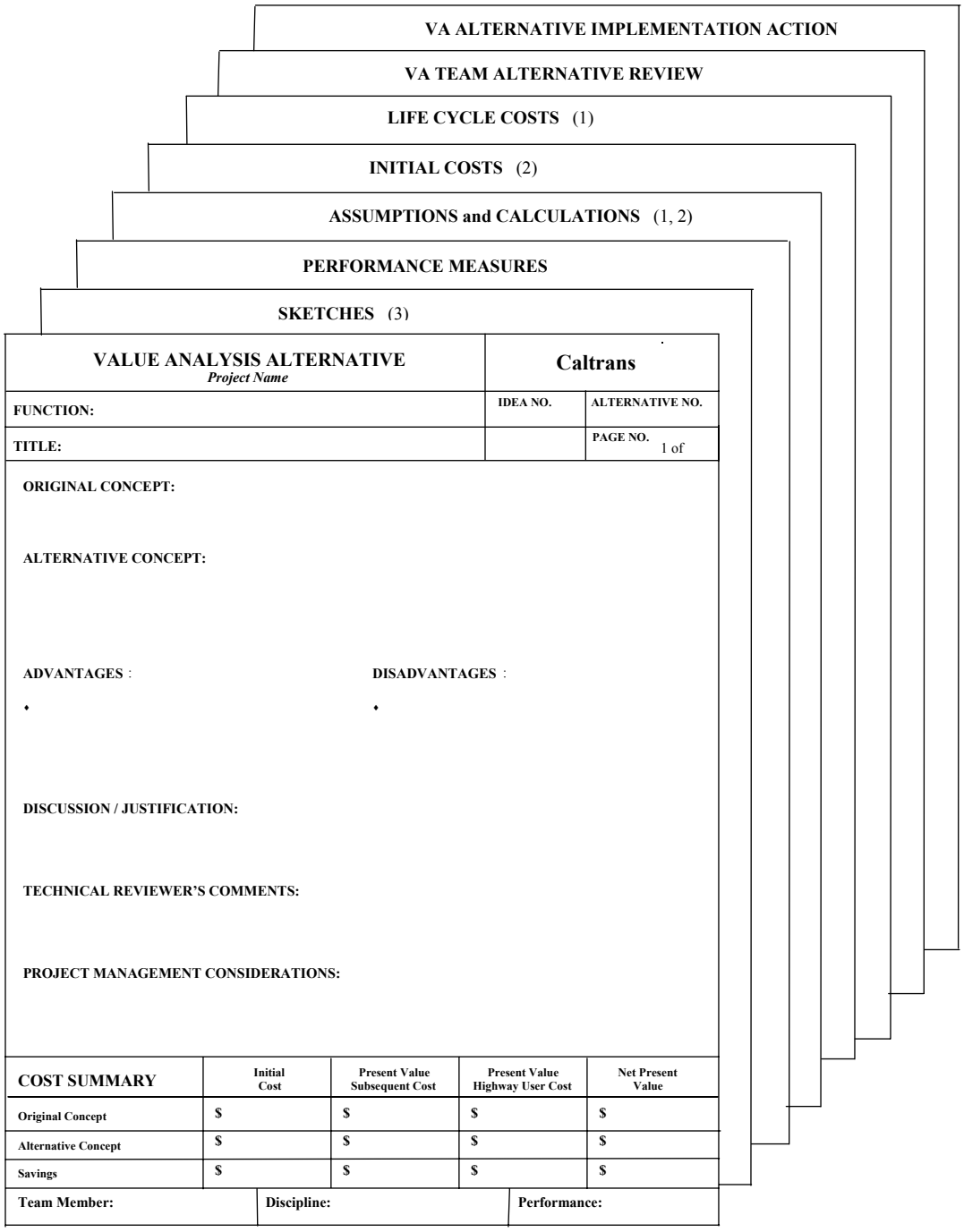
All of the documentation is transcribed and edited for improved readability, and to facilitate electronic reporting.

Examples of each form used to document the VA alternatives follow. Refer to the VA Team Guide for information regarding how the forms are completed.

VA Alternative. *The example VA alternative illustrates the documentation required for an alternative. See the VA Team Guide for detailed instructions for completing these forms.*

VA ALTERNATIVE DOCUMENTATION

A complete VA alternative is a stand-alone document using the following forms:



Notes: (1) Optional, depending on needs of the alternative
(2) Additional back-up sheets may support calculations, and costs
(3) Include original and alternative sketches

VALUE ANALYSIS ALTERNATIVE *Example Project*	Caltrans	
FUNCTION: Increase Capacity	**IDEA NO.** IC-3	**ALTERNATIVE NO.** 8.0
TITLE: Undercrossing at Olive Hill Road with Interchange		**PAGE NO.** 1 of 8

ORIGINAL CONCEPT:

The original concept shows an at-grade intersection at Olive Hill Road. This intersection has a dual left-turn lane and single right-turn lane in each direction on the mainline. The intersection will be signalized to control left-turn movements. This is the only signalized intersection within the project limits.

ALTERNATIVE CONCEPT:

This alternative provides grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area.

ADVANTAGES:

- Traffic operations are significantly improved
- Maintains good access and visibility of the shopping center from the State Route
- Improves access to the residential area serviced by Olive Hill Road
- Improves pedestrian and cyclist safety crossing the State Route
- Reduces traffic conflicts that contribute to local accident concentration
- Eliminates at-grade intersection
- Reduces number of traffic lights on State Route
- Works with all alternatives in PSR
- Minimal increase in environmental impacts
- The Base Alignment already takes the majority of the businesses at the southeast corner
- Improves transition to a new County bridge over the river on Olive Hill

DISADVANTAGES:

- Increases construction cost
- Requires visual impact analysis during the environmental process
- Requires acquiring businesses at the southeast corner
- Freeway-type interchange may not match rural character
- Hook ramps are generally undesirable
- Requires dedication of 1,700 feet of existing SR 67 to the County (frontage road in front of shopping center)
- Hinders bicycle movements on the State Route; requires bicyclists to exit at Olive Hill and reenter the State Route

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	$ 1,804,000	$ 357,000	$ 34,146,000	$ 36,307,000
Alternative Concept	$ 3,786,000	$ 441,000	$ 0	$ 4,227,000
Savings	$ (1,982,000)	$ (84,000)	$ 34,146,000	$ 32,080,000

Team Member: Mark Creveling	**Discipline:** Bridge Engineer	**PERFORMANCE:** +15%

VALUE ANALYSIS ALTERNATIVE *Project Name*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**ALTERNATIVE NO.** 8.0	**PAGE NO** 2 of 8

DISCUSSION / JUSTIFICATION:

The grade separation would provide a significant improvement to traffic operations (service) on the mainline, and it would correct conditions that contribute to an above statewide average accident rate in this area. This is the main area within the entire project limits with a high accident concentration rate. This alternative maintains good access and visibility to the shopping center, which is important to the local merchants and residents. Elimination of the signalized intersection will improve local traffic circulation patterns, reduce travel delays, and reduce conflicts between residential traffic and regional truck traffic.

The State Route is a major bicycle route in the area, and the grade separation will require bicyclists to exit and reenter at Olive Hill to avoid conflicts with motorists at the on- and off-ramps. The geometrics of the ramps are based on a similar interchange recently constructed in an area with similar terrain.

The project scope improvements associated with this alternative should justify the increase in project cost.

TECHNICAL REVIEWER COMMENTS:

Environmental: This slightly increases the impact to the wetland. Added mitigation will be necessary. This should not be a major problem to the delivery of the project.

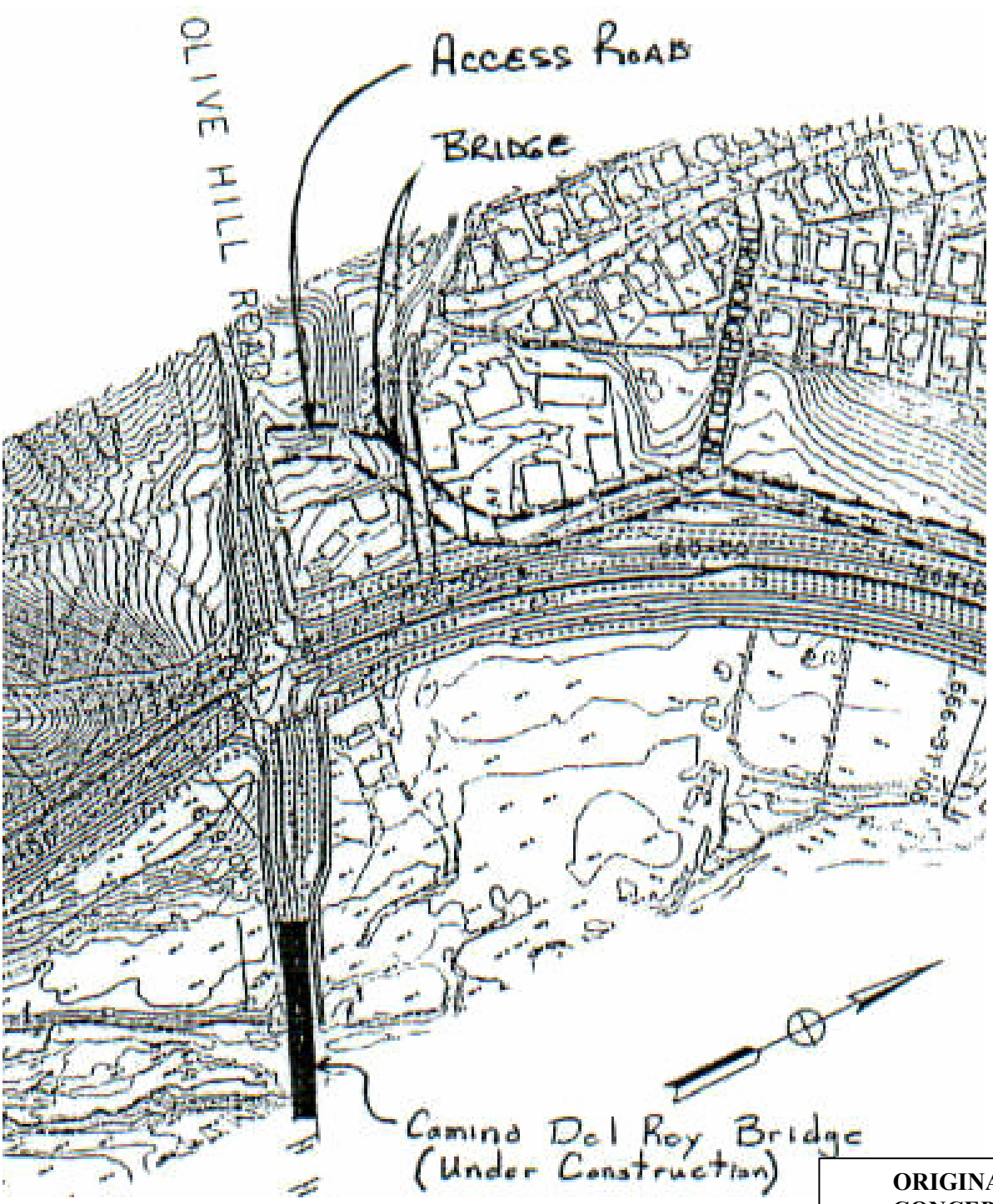
Design Reviewer: Bike traffic will need to exit and enter the State Route to avoid crossing the on- and off-ramps. This alternative should greatly improve traffic operations at this location.

PROJECT MANAGEMENT CONSIDERATIONS:

Perform a complete evaluation to accurately determine traffic benefits, costs, and the environmental impact of this alternative. This study only looked at the immediate interchange area. The alignment may have impacts beyond that need to be studied.

During the Draft PR phase, determine if a full diamond is viable at this location, and identify the cost and environmental impacts.

SKETCHES ***Example Project***	**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 6.0	**PAGE NO.** 3 of 8



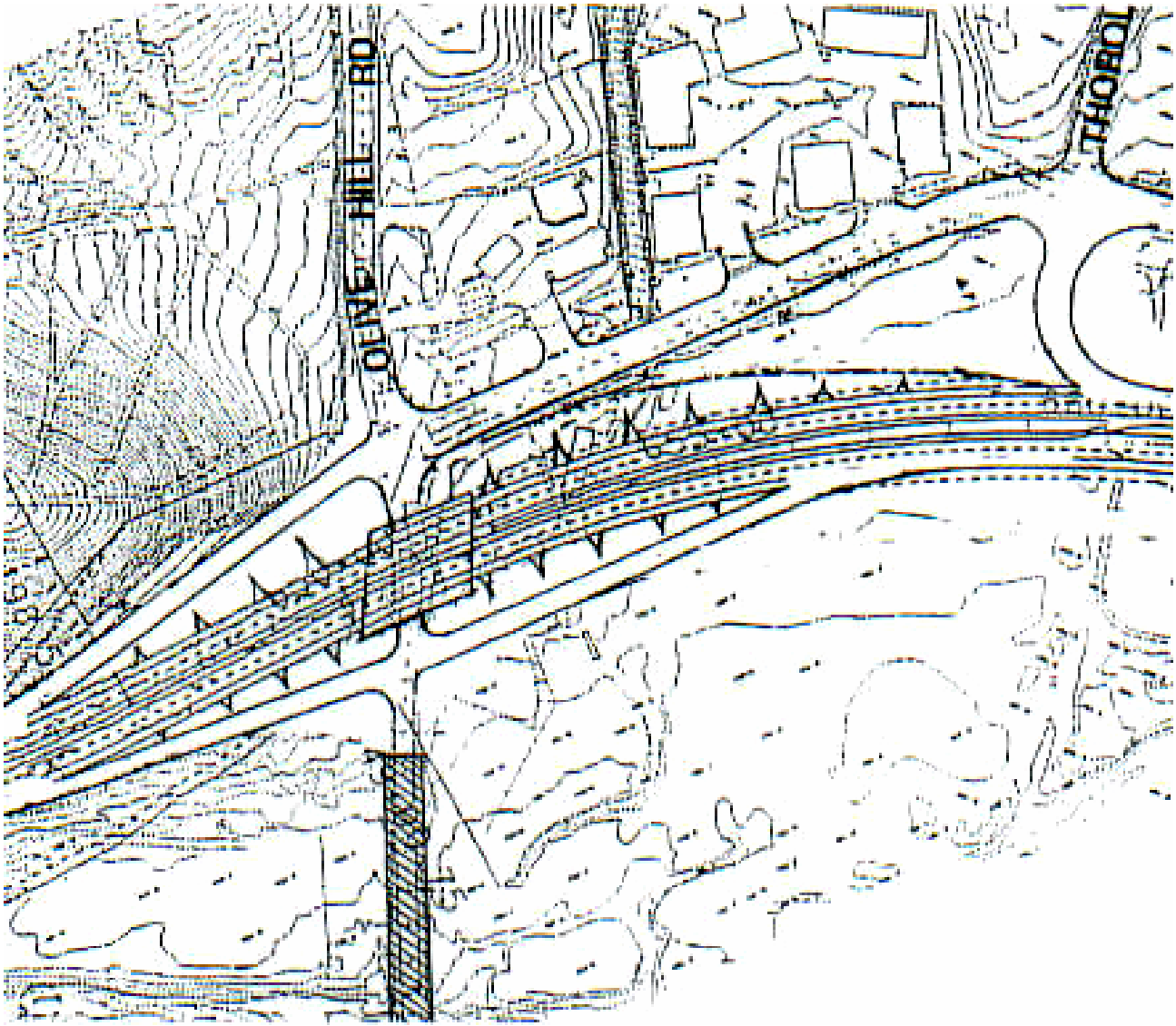
ORIGINAL CONCEPT:
At-Grade Intersection

Example

SKETCHES *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0	**PAGE NO.** 4 of 8

ALTERNATIVE CONCEPT:
Undercrossing with
Tight Diamond Interchange

Example



PERFORMANCE MEASURES ***Example Project***	**Caltrans**		
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0		**PAGE NO.** 5 of 8
CRITERIA and RATING RATIONALE for ALTERNATIVE	**Performance**	**Original**	**Alternative**
MAINLINE TRAFFIC OPERATIONS Greatly improves mainline operations in this area; the traffic signal is eliminated along with slowing for turning traffic, as the on-ramps will get traffic up to speed before merging into traffic. While this is a significant improvement locally, it is a minor improvement when considering the overall project.	Rating	8	9
	Weight	24	24
	Contribution	192	216
HIGHWAY USER SAFETY Eliminates conflicts at the entrance and exit to the shopping center northeast of the intersection and associated left-turn movements—especially truck turning movements. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Rating	6	9
	Weight	29	29
	Contribution	174	261
ACCESS Maintains good local access to businesses and homes in the area.	Rating	7	7
	Weight	19	19
	Contribution	133	133
LOCAL TRAFFIC OPERATIONS Improves traffic flow on local streets, as traffic the signal is improved. Adds a side entrance to the shopping center from Olive Hill.	Rating	7	8
	Weight	10	10
	Contribution	80	80
CONSTRUCTIBILITY Grade separation increases construction time and complexity in the area. This will not impact the overall schedule, but it will increase local impact during construction.	Rating	7	6
	Weight	2	2
	Contribution	14	12
ENVIRONMENTAL IMPACTS Visual impact of grade separation needs to be evaluated. No other environmental impacts are anticipated.	Rating	6	5
	Weight	14	14
	Contribution	84	70
RIGHT-OF-WAY IMPACTS The westbound on-ramp would require added right-of-way from a market, and it would probably require a full take of the parcel that is currently planned for just a partial take.	Rating	5	4
	Weight	2	2
	Contribution	10	8
Total Performance:		**677**	**780**
Net Change in Performance:			**+15%**

ASSUMPTIONS and CALCULATIONS *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0	**PAGE NO.** 6 of 8

Design Assumptions

- Current intersection has dual left-turn lanes and a single right-turn lane in each direction with standard deceleration lanes for all turning movements. This design will be similar to the recently completed interchange on SR 87 at Wilder Road, which is about 15 miles from this location.
- The area of excavation and pavement for these turning lanes are approximately the same as the off-ramps and their shoulders for the proposed interchange.

Assumptions for Construction Cost Estimates

- Added area for on-ramps:
  12-foot lane + two 8-foot shoulders = 28 feet wide
  Length of on-ramps = ~850 feet each
  Therefore, total added area for ramps = 2 x 28 feet x 850 feet = 47,500 SF ~Say 50,000 SF
- Undercrossing = 80 feet wide and 150 feet long = 12,000 SF
- Add 10% mark-up to the undercrossing for uncertainties in geotechnical information and foundation design.

Assumptions for Life Cycle Cost Estimates

- Maintenance and inspection cost is based on $5,000 per lane mile for the area of influence, which is ~0.5 mile long.
- Alternative is increased by 1/3 to account for added area of on-ramps and overcrossing. Also increased to account for bridge inspection.
- Energy cost of traffic signals is eliminated in the VA alternative.
- Rehabilitation cost is increased by 1/6 to account for added pavement area to be rehabilitated.
- Highway User Costs are the differences based on the Caltrans Highway User Benefit Cost Model, using the following key assumptions:
  - ADT: year 1 = 55,000, year 20 = 77,000
  - Area of influence = 0.5 mile
  - Average operating speed is increased 5 mph with grade separation.
  - The accident rate in this area is over 50% higher than the statewide average at this location (3.04 per MVM). This is not expected to change significantly with the new project, as accidents relate to both the entrance/exit to the shopping center to the northeast corner of the intersection and the left-turn movement at the intersection, especially truck turning movements. Although the statewide average for a highway with a grade-separated facility is 1.0 per MVM, we are assuming 1.52 for the grade-separated alternative.
  - Truck traffic is ~9% of the total

INITIAL COSTS ***Example Project***							**Caltrans**
TITLE Undercrossing at Olive Hill with Interchange						**NUMBER** 8.0	**PAGE NO.** 7 of 8
CONSTRUCTION ELEMENT		**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
Description	**Unit**	**Quantity**	**Cost/Unit**	**Total**	**Quantity**	**Cost/Unit**	**Total**
ROADWAY ITEMS							
At Grade Intersection	SF	64,300	$ 3.50	$225,050			$0
Signals	EA	4	$ 110,000	$440,000			$0
Access Road	SF	30,000	$ 3.50	$105,000			$0
Traffic Control	LS	1	$ 100,000	$100,000	1	$ 50,000	$50,000
Roadway Embankment	CY			$0	68,000	$ 7.00	$476,000
Ramps	SF			$0	50,000	$ 3.50	$175,000
ROADWAY SUBTOTAL				*$870,050*			*$701,000*
ROADWAY MARK-UP		*50%*		*$435,025*			*$350,500*
VA ADDED MARK-UP				*$0*			*$0*
ROADWAY TOTAL				*$1,305,075*			*$1,051,500*
STRUCTURE ITEMS							
Undercrossing (150x80)	SF			$0	12,000	$130.00	$1,560,000
Channel Bridge (30x160)	SF	4,800	$80.00	$384,000			$0
STRUCTURE SUBTOTAL				*$384,000*			*$1,560,000*
STRUCTURE MARK-UP		*30%*	*$384,000*	*$115,200*	*30%*	*$1,560,000*	*$468,000*
VA ADDED MARK-UP		*0%*	*$384,000*	*$0*	*10%*	*$1,560,000*	*$156,000*
STRUCTURE TOTAL				*$499,200*			*$2,184,000*
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition	LS			$0	1	$500,000	$500,000
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL				*$0*			*$500,000*
ENVIRONMENTAL MITIGATION ITEMS							
CAPITAL OUTLAY SUPPORT ITEMS	LS			$0	$1	50,000	$50,000
Reengineering and Redesign				$0			$0
Project Engineering				$0			$0
TOTAL				$1,804,275			$3,785,500
TOTAL (Rounded)				$1,804,000			$3,786,000
						SAVINGS	($1,982,000)

LIFE CYCLE COSTS ***Example Project***				**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange				**NUMBER** 8.0	**PAGE NO.** 8 of 8
Life Cycle Period 20 Years		Real Discount Rate 4.50%		**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST				$1,804,000	$3,786,000
Service Life-Original 20 Years Service Life-Alternative 20 Years		**INITIAL COST SAVINGS:**			**($1,982,000)**
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection				$15,000	$20,000
2. Operating					
3. Energy				$500	$0
Total Subsequent Annual Costs:				$15,500	$20,000
Present Value Factor (P/A):				13.008	13.008
PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS (Rounded):				**$202,000**	**$260,000**
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original	15	300,000	0.5167	$155,010	
Rehabilitations - Alternative	15	350,000	0.5167		$180,845
Repairs - Original				$0	
Repairs - Alternative					$0
Expended Service Life - Original				$0	
Expended Service Life - Alternative					$0
Salvage - Original				$0	
Salvage - Alternative					$0
PRESENT VALUE OF SUBSEQUENT SINGLE COSTS (Rounded):				**$155,000**	**$181,000**
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)				**$357,000**	**$441,000**
TOTAL SUBSEQUENT COSTS SAVINGS:					**($84,000)**
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident					($32,264,000)
2. Travel Time					($2,714,000)
3. Vehicle Operating					$832,000
TOTAL HIGHWAY USER ANNUAL COSTS:				**$0**	**($34,146,000)**
TOTAL HIGHWAY USER COST SAVINGS:					**$34,146,000**
F. TOTAL PRESENT VALUE COST (A+D+E)				**$2,161,000**	**($29,919,000)**
TOTAL LIFE CYCLE SAVINGS:					**$32,080,000**

VA TEAM ALTERNATIVE REVIEW ***Example Project***	**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0

Team Member: Wendy Weldon

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Luis Diaz

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Mary E. Campbell

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Need to discuss impact on bicyclists, as the State Route is a major part of the County bicycle route in this area. *The VA alternative was edited to address this comment.*

Team Member: Jeff West

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Terry Hodges

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Note as a disadvantage that the road between Thoroughbred Lane and Olive Hill in front of the shopping center will need to be transferred to the County. Sometimes the County does not want to take over these frontage roads unless we rebuild them first. *The frontage road will need to be realigned and reconstructed as part of this proposal; therefore, this will not be an issue with the County.*

VA ALTERNATIVE IMPLEMENTATION ACTION (PRELIMINARY) ***Example Project***	**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0
RESPONSES / **Prepared by:**	**Date:**

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance:

DISPOSITION

☐ **Accept**

☐ **Conditionally Accept**

☐ **Reject**

Validated Performance

Implementable Portions:

If Alternative is Rejected

Was rejection due to VA Study taking place too late in the project development process to implement the change?

Yes ☐ No ☐

Validated Cost Savings:

Validated Savings

Project Development Support Cost Savings

Project Development Delivery Impact:

	No Change	Reduced by	Increased by
PID	☐	Mo.	Mo.
PA&ED	☐	Mo.	Mo.
PS&E	☐	Mo.	Mo.
Const.	☐	Mo.	Mo.

Other Comments:

Idea Evaluation

IDEA EVALUATION

The Idea Evaluation section of the report discusses the procedures used to develop and evaluate the creative ideas, and to document the evaluated and ranked ideas. It is a detailed methodology that forms the basis for an objective, criteria-based evaluation of ideas so that a broad set of key criteria are applied to the ideas rather than a narrow set of only one or two criteria.

Report Text. The Idea Evaluation text provides a summary of the process used to evaluate the creative ideas generated by the VA team.

Idea Evaluation. *The example Idea Evaluation section covers three topics:*

- ***Performance Criteria*** *– Describes the key evaluative criteria*
- ***Evaluation Process*** *– Describes the process used by the VA team to evaluate the ideas*
- ***Idea Evaluation Forms*** *– The use of this form is described in the Team Guide.*

IDEA EVALUATION

INTRODUCTION

The ideas generated by the VA team are carefully evaluated, and project-specific criteria are applied to each idea to assure an objective evaluation.

PERFORMANCE CRITERIA

The VA team used the paired comparison method to prioritize the key performance criteria for this project:

- Mainline Traffic Operations
- Highway User Safety
- Access
- Local Traffic Operations
- Constructibility
- Environmental Impacts
- Right-of-Way Impact

The team enlisted the assistance of the stakeholders and designers (when available) to develop these criteria so that the evaluation would reflect their specific requirements.

EVALUATION PROCESS

The VA team, as a group, generated and evaluated ideas on how to perform the various functions. The idea list was grouped by function or major project element. While ideas on the overall project were evaluated as a group, ideas relating to a specific technical discipline may have been evaluated by the team member representing that discipline.

The team compared each of the ideas with the original concept for each of the performance criteria to determine whether it was better than, equal to, or worse than the original concept. The team reached a consensus on the ranking of the idea. High-ranked ideas would be developed further; low-ranked ones would be dropped from further consideration.

IDEA EVALUATION FORMS

All of the ideas that were generated during the creative phase using brainstorming techniques were recorded on the following Idea Evaluation forms. These ideas were discussed and the advantages and disadvantages of each were listed.

IDEA EVALUATION FORMS

The Idea Evaluation worksheets are used to record the discussions of the VA team during the Evaluation Phase. The documented information shows how the team reached a consensus about the suitability of an alternative idea and ranks all ideas for further development. The form can be handwritten by a team member or entered into a computer database by a staff assistant during the evaluation session.

Idea Evaluation. *The example Idea Evaluation (form T-11) records the results of the evaluation discussion. The performance measures are coded (M, S, A, L, CE, RW) to facilitate discussion and recording of ratings.*

Performance Criteria. *The VA team, as a group, judges the ideas relative to performance of the functions required. Ideas are rated on a five-point system with a maximum possible rating of a plus two (+2) points and a minimum of negative two (-2) points:*

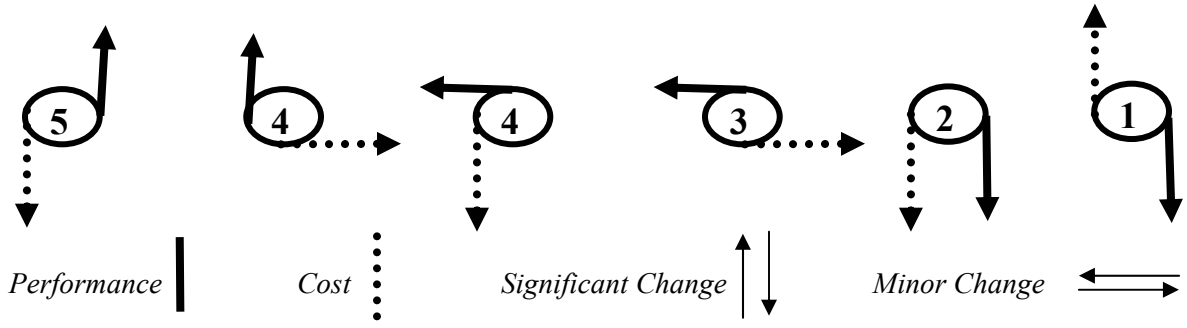
+2 Greatly improved	*0 No significant change*	*-1 Slight degradation*
+1 Some improvement		*-2 Significant degradation*

Advantages/Disadvantages. *Notations on the pros and cons of the idea are made. Complete documentation is essential both as a record of the team evaluation and as a guide to the future development of the alternatives. Advantages and disadvantages should describe the reason for a ± change in the rating.*

Cost: *Once the idea has been evaluated against the performance measures, the VA team should make a cursory assessment of the idea's potential cost impacts using the same ranking system identified above for performance measures.*

Rank. *Once each idea is fully evaluated, it is given a ranking number, based on a scale of 1 to 5:*

5 Significant Value Improvement – Develop as a VA alternative
4 Good Value Improvement – Develop as a VA alternative
3 Minor Value Improvement – Develop as time permits
2 Minor Value Degradation – Do not develop further
1 Significant Value Degradation, or does not meet project purpose and need – do not develop further



Note: During the VA Study, all alternatives developed will be documented on the VA forms. If alternatives are developed and found to have no real cost or performance impact, they may be summarized in the narrative of the VA Alternatives section of the report. This is to ensure that the significant alternatives receive proper focus.

IDEA EVALUATION *Example Project*										Caltrans		
Ideas		Performance Criteria							Advantages	Disadvantages	$	Rank
No.	Function	M	S	A	L	C	E	RW				
	INCREASE CAPACITY											
IC-1	Relocate/consolidate/improve at-grade intersections	0	+2	0	+2	0	0	0	◆ Could reduce environmental impact ◆ Reduces vehicle conflicts	◆ Could negatively impact previously avoided environmentally sensitive areas	0	4
IC-2	Have variable median appropriate for topography and location	0	-1	0	0	+1	+2	+2	◆ Reduces earthwork in large cut areas ◆ Avoids environmentally sensitive areas ◆ Reduces footprint ◆ Reduces right-of-way requirements	◆ Reduces recovery area ◆ Challenges design criteria ◆ Reduces opportunity for future widening	+2	5
IC-3	Undercrossing at Olive Hill Road with interchange	+2	+2	+2	+2	-1	-1	-1	◆ Improves traffic operations ◆ Good sight distance ◆ Improves pedestrian and cyclist safety crossing State Route ◆ Eliminates at-grade intersection ◆ Reduces number of traffic lights ◆ Improves transition to new County bridge	◆ Increases construction cost ◆ Requires additional right-of-way ◆ Hook ramps are generally undesirable ◆ Freeway-type interchange may not match rural area ◆ Hinders bicycle movements on State Route	-1	4

Ranking Scale: **5 = Significant Value Improvement** **2 = Minor Value Degradation**
4 = Good Value Improvement **1 = Significant Value Degradation, or Does Not Meet Project Purpose and Need**
3 = Minor Value Improvement

Evaluation Criteria: **Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**

M = Mainline Traffic Operations **S = Highway User Safety** **A = Access** **L = Local Traffic Operations**
C = Constructibility **E = Environmental Impacts** **RW = Right-of-Way Impacts**

Value Analysis Process

VALUE ANALYSIS PROCESS

This report section gives an overview of the pre-study preparation, study performed, and post-study implementation activities, and includes the agenda and daily attendance sheets. It is a record of the persons participating on the VA team, as well as those who assisted during the study. It includes a detailed summary of the VA methodology followed during the study.

Value Analysis Process. *The example Value Analysis Process section summarizes the value methodology:*

- ***Introduction*** *– Introduces the VA procedures used in the study*
- ***Preparation*** *– States the activities done before the formal study began*
- ***VA Study*** *– Summarizes the ten activities within the team study*
- ***Report*** *– Outlines the two activities following the study*

VA Study Agenda. *The example agenda used in the VA Study is a six-day VA Study and a two-day Segment 3. The specific agenda is tailored to the VA Study as needed.*

Daily Attendance Sheets. *The example daily attendance sheets record the attendance of each person involved in each day of a study.*

VALUE ANALYSIS PROCESS

INTRODUCTION

The Value Analysis process involves fifteen activities needed to accomplish a VA Study, organized in three parts: Preparation, VA Study, and Report. The following Caltrans VA Study Activity Chart describes each activity; the individual tasks are summarized below.

PREPARATION

Prior to the start of a VA Study, the District VA Coordinator (DVAC) and Team Leader carry out the following three activities:

- **Initiate Study** – Identify study project; define study goals; prepare draft study charter and Task Order Initiation Document.
- **Organize Study** – Conduct preparation meeting; select team members; finalize study charter and Task Order Initiation Document
- **Prepare Data** – Collect and distribute data; prepare cost models; develop LCC model.

All of the information gathered prior to the VA Study is given to the team members for their use.

VA STUDY

There are ten activities carried out by the VA team during the performance of the study, organized in three segments:

Segment 1

- **Inform Team** – Receive designer presentation; develop performance criteria; visit project site.
- **Analyze Functions** – Identify basic functions and cost drivers; prepare FAST diagram.
- **Create Ideas** – List a large quantity of alternative ideas; use group/individual brainstorming.
- **Evaluate Ideas** – Evaluate all ideas against performance criteria; rank all ideas.

Segment 2

- **Develop Alternatives** – Develop high-ranked ideas into VA alternatives; measure performance.
- **Critique Alternatives –** Team and Technical Reviewer review of alternatives to develop and ensure team consensus and technical viability. Develop and rate recommended VA alternatives.
- **Present Alternatives** – Give interim presentation of alternatives; prepare preliminary report.

Segment 3

- **Assess Alternatives** – Review alternatives; prepare draft implementation decisions.
- **Resolve Alternatives** – Resolve dispositions; edit and revise alternatives; summarize results.
- **Present Results** – Give final presentation of accepted alternatives.

REPORT

Following the VA Study, the Team Leader assembles all study documentation into the final report:

- **Publish Results** – Prepare Final VA Study Report; distribute printed and electronic copies.
- **Close Out VA Study** – Resolve open conditionally accepted VA alternatives and update the Executive Summary and VASSR. Provide final deliverables to the HQ VA Branch.

The VA Study is complete when the report is issued as a record of the VA team's analysis and development work, as well as the project development team's implementation dispositions for the alternatives.

Performance measures are integral to the VA process and are used throughout the VA Study. The following detailed discussion of the performance measures provides better clarification of how they are used within the VA process. A VA Study Activity Chart, which outlines the fifteen VA activities in more detail, follows the performance measures. The VA Study Agenda and Meeting Attendees sheet, which document the schedule and participants in the VA Study, are at the end of this section.

CALTRANS PROJECT PERFORMANCE MEASUREMENT

INTRODUCTION

The methodology described herein measures project value by correlating the performance of project scope and delivery to the project costs. The objective of this methodology is to prescribe a systematic, objective approach to study and optimize a project budget, schedule, and scope. This serves the transportation community by identifying a quantifiable methodology to effectively analyze and compare the three project management components (scope, schedule, and budget), and measure resulting project value.

Project performance measures are an integral part of the Caltrans Value Analysis (VA) methodology and consist of a set of techniques as follows:

- Identify key project (scope and delivery) performance criteria for the project
- Establish the hierarchy and impact of these criteria upon the project
- Establish the baseline of the current project performance by evaluating and rating the effectiveness of the current design concepts
- Identify the change in performance of alternative project concepts generated by the study
- Measure the aggregate effect of alternative concepts relative to the baseline project's performance as a measure of overall value improvement

It is important that the project performance criteria be well defined and agreed to by the stakeholders at the start of the study, as they are used throughout the study to identify, evaluate, and document alternatives. Project scope performance improvements are also one of the critical quantifiable results of a Caltrans study. All subsequent references to "project scope and delivery performance" will be abbreviated to "performance".

The primary goal of value analysis is to improve project value. A simple way to think of value in terms of an equation is as follows:

$$\frac{\textit{Value} = \textit{Project Performance (Scope \& Delivery)}}{\textit{Project Cost}}$$

Value analysis has traditionally been perceived as an effective means for reducing project costs. This paradigm only addresses one part of the value equation, oftentimes at the expense of overlooking the role that VA can play with regard to improving project performance. Project costs are fairly easy to quantify and compare through traditional estimating techniques. Performance is not so easily quantifiable.

The Caltrans VA Program has developed a unique methodology using a variety of techniques aimed at identifying, defining, and quantifying performance. Once this has been accomplished, the interrelationship between cost and performance can be quantified and compared in terms of how they contribute to overall value.

The direct and active involvement of the project's stakeholders is at the core of this process. The VA Team Leader will lead Caltrans and external stakeholders through the methodology, using the power of the process to distill subjective thought into an objective language that everyone can relate to and understand. The dialog that develops forms the basis for the VA team's understanding of the performance requirements of the project and to what degree the current design concept is meeting those requirements. From this baseline, the VA team can focus on developing alternative concepts that will quantify both performance and cost and contribute to overall project value.

The Caltrans approach to project performance yields the following benefits:

- Builds consensus among project stakeholders (especially those holding conflicting views)
- Develops a better understanding of a project's goals and objectives
- Develops a baseline understanding of how the project is meeting performance goals and objectives
- Identifies areas where project performance can be improved through the VA process
- Develops a better understanding of a VA alternative's effect on project performance
- Develops an understanding of the relationship between performance and cost in determining value
- Uses value as the true measurement for the basis of selecting the right project or design concept
- Provides decision makers with a means of comparing costs and performance (i.e., costs vs. benefits) in a way that can assist them in making better decisions.

METHODOLOGY

The application of performance methodology consists of the following steps:

1. Define the major performance criteria
2. Determine the relative importance of the criteria
3. Establish the performance "baseline" for the original design
4. Evaluate the performance of the VA alternative concepts
5. Compare the performance ratings of alternative concepts to the "baseline" project

Assumptions

Before embarking on the details of this methodology some assumptions need to be identified:

- An evaluation of the creative ideas (ideas generated during the brainstorming, creative sessions—not to be confused with VA alternative concepts described in Step 4) is done between Steps 3 and 4. The idea evaluation process remains true to the "value" approach of measuring performance and costs; however, due to the time constraints, the idea evaluation is a qualitative form of evaluating ideas, as opposed to the quantitative procedures done in the other steps.

- The methodology described in the following steps assumes the project functions are well established. Project functions are "the what" the project delivers to its users and stakeholders; a good reference for the project functions can be found in the environmental document's purpose and need statement. Caltrans' project functions are generally well defined prior to the start of the VA Study. In the event that project functions have been substantially modified, the methodology must begin anew from the beginning (Step 1).

Step 1 – Determine the Major Performance Criteria

Performance criteria can generally be divided between Project Scope components (Highway Operations, Environmental Impacts, and System Preservation) and Project Delivery components.

The VA Team Leader will initially request that representatives from Caltrans and external stakeholders identify performance criteria that they feel are essential to meeting the overall need and purpose of the project. Usually four to eight criteria are selected. It is important that all potential criteria be thoroughly discussed. The information that comes out of this discussion will be valuable to both the VA team and Caltrans. It is important that the criteria be discretely defined, and they must be quantifiable in some form. By quantifiable, it is meant that a useable scale must be delineated with values given on a scale of 1 to 10. A "1" indicates poor value, while a "10" indicates excellent value. The vast majority of performance criteria that typically appear in Caltrans VA studies have been standardized. This standardized list can be used "as is" or adopted with minor adjustments as required. Every effort should be made to make the ratings as objective as possible.

Step 2 – Determine the Relative Importance of the Criteria

Once the group has agreed upon the project's performance criteria, the next step is to determine their relative importance in relation to each other. This is accomplished through the use of an evaluative tool termed in this paper as the "Performance Criteria Matrix." This matrix compares the performance criteria in pairs, asking the question: "Which one is more important to the project?" A letter code (e.g., "a") is entered into the matrix for each pair, identifying which of the two is more important. If a pair of criteria is considered to be of essentially equal importance, both letters (e.g., "a/b") are entered into the appropriate box. This, however, should be discouraged, as it has been found that in practice a tie usually indicates that the pairs have not been adequately discussed. When all pairs have been discussed, the number of "votes" for each is tallied and percentages (which will be used as weighted multipliers later in the process) are calculated. It is not uncommon for one criterion to not receive any "votes." If this occurs, the criterion is given a token "vote", as it made the list in the first place and should be given some degree of importance.

It is important for the VA Team Leader to remind the group that, as they evaluate each pair of criteria, they should think of performance trade-offs in hypothetical terms as they relate to the project's overall need and purpose. For instance, the VA Team Leader might state, "If we were considering a concept that would improve mainline operations, but at the expense of reducing access between the freeway and local streets, which criterion would be more critical in meeting the project's intended need and purpose?" The team should also be reminded that these performance criteria will be used to evaluate the merits of alternative concepts generated during the course of the VA Study. As such, the group should keep an open mind and base their evaluation on what is possible rather than what exists in terms of the current design concept.

Step 3 – Establish the Performance "Baseline" for the Original Design

The next step in the process is to evaluate how well the original design is addressing the project's performance criteria. This step establishes a "baseline" against which the VA alternative concepts can be compared. The Performance Rating Matrix is used to assist the VA team in determining the performance ratings for the original design concept. Representatives from the Caltrans design team and external stakeholders next begin assigning a 1 to 10 rating for each criterion, using the definitions and scales developed in Step 1.

Once the 1 to 10 ratings for the various criteria have been established, their total performance should be calculated by multiplying the criteria's weight (which was developed in Step 2) by its rating. Once the total performance for each criterion has been determined, the original design's total performance can be calculated by adding all of the scores for the criteria. The concept's total performance will be somewhere between 100 and 1,000 points. A concept scoring 1,000 would represent a hypothetically "perfect" design concept, with all performance criteria being addressed to their theoretical maximum. This numerical expression of the original design's performance forms the "baseline" against which all alternative concepts will be compared.

Step 4 – Evaluate the Performance of the VA Alternative Concepts

Once the performance baseline has been established for the original design concept, it can be used to help the VA team develop performance ratings for individual VA alternative concepts as they are developed during the course of the VA Study. The Performance Measures form is used to capture this information. This form allows a side-by-side comparison of the original design and VA alternative concepts to be performed.

It is important to consider the alternative concept's impact on the entire project, rather than on discrete components, when developing performance ratings for the alternative concept

Step 5 – Compare the Performance Ratings of Alternative Concepts to the "Baseline" Project

The last step in the process completes the Performance Rating Matrix that was initially begun to develop the performance ratings for the original design concept. The VA team groups the VA alternatives into a set (or sets) to provide the decision makers a clear picture of how the alternatives fit together into possible solutions. At least one set is developed to present the VA team's consensus of what should be implemented. Additional sets are developed as necessary to present other combinations to the decision makers that should be considered. The set(s) of VA alternatives are rated and compared against the original concept. The performance ratings developed for the VA alternative sets are entered into the matrix, and the summary portion of the Performance Rating Matrix is completed. The summary provides details on net changes to cost, performance, and value, using the following calculations.

- % Performance Improvement = Δ Performance VA Alt. Set / Total Performance Original Concept
- Value Index = Total Performance / Total Cost (in Millions)
- % Value Improvement = ΔValue Index VA Alt. Set / Value Index Original Concept

The stakeholders are asked to validate the performance measures and rationale at the Implementation Meeting. The rationale for the numerical rating change for each alternative in each set is developed. The Performance Rating Matrix shows the numerical change for each performance measure and alternative set. The Total Performance is calculated by multiplying the criteria weight by the performance rating for each performance measure of either the original concept or VA set.

CONCLUSION

The development and integration of performance measurements into the value methodology employed on Caltrans studies has improved the effectiveness of the Value Analysis Program as applied to highway projects by providing a reliable, integrated method of measuring performance and, consequently, value. This in turn has allowed the program to more easily discuss disposition of the alternatives, justify alternatives with cost increases, apply value analysis more effectively to projects in the earlier stages of project development, and to better capture input from participating project stakeholders.

The application of performance measurements within a VA Study neither supplants nor reduces the authority of the Project Development Team (notably Design and Environmental Units) from developing, analyzing, and refining the project scope issue contained in the above two major categories. The intent of the project (scope) performance measurements, within the context of a VA Study, is for the VA team to address the relevant project scope issues. These may help the Project Development Team, but they do not supplant their role as the final decision makers on the project scope.

Caltrans Value Analysis Activity Chart

PREPARATION

INITIATE STUDY — 1
- Identify study project
- Identify study roles and responsibilities
- Define study goals
- Select team leader
- Prepare draft Study Charter

ORGANIZE STUDY — 2
- Conduct Pre-Study Meeting
- Select team members
- Identify stakeholders, decision-makers, and technical reviewers
- Identify data collection
- Select study dates
- Determine study logistics
- Update VA Study Charter

PREPARE DATA — 3
- Collect and distribute data
- Develop construction cost models
- Develop highway user benefit / life cycle cost (LCC) model

VA STUDY

Segment 1

INFORM TEAM — 4
- Review study activities and confirm reviewers
- Present design concept
- Present stakeholders' interests
- Review project issues and objectives
- Identify key functions and performance criteria
- Visit project site

ANALYZE FUNCTIONS — 5
- Analyze project data
- Expand project functions
- Prepare FAST diagram
- Determine functional cost drivers

CREATE IDEAS — 6
- Focus on functions
- List all ideas
- Apply creativity and innovation techniques (group and individual)

EVALUATE IDEAS — 7
- Apply key performance criteria
- Consider cost impacts
- List advantages and disadvantages
- Rate each idea
- Rank all ideas
- Assign alternatives for development

Segment 2

DEVELOP ALTERNATIVES — 8
- Develop alternative concepts
- Prepare sketches and calculations
- Measure performance
- Estimate costs, LCC benefits/costs

CRITIQUE ALTERNATIVES — 9
- VA Alternatives Technical Review
- VA Alternatives Team Consensus Review
- Identify mutually exclusive groups of alternatives
- Identify VA sets
- Validate performance

PRESENT ALTERNATIVES* — 10
- Present findings
- Document feedback
- Confirm pending reviews
- Prepare preliminary report

**Interim presentation of study findings*

Segment 3

ASSESS ALTERNATIVES** — 11
- Review Preliminary Report
- Assess alternatives for project acceptance
- Prepare draft implementation dispositions

***Activities performed by PDT, Technical Reviewers, and Stakeholders*

RESOLVE ALTERNATIVES — 12
- Review implementation dispositions
- Resolve implementation actions with decision-makers and stakeholders
- Edit alternatives
- Revisit rejected alternatives, if needed

PRESENT RESULTS* — 13
- Present results
- Obtain management approval on implemented alternatives
- Summarize performance, cost, and value improvements

**Final presentation of study results*

REPORT

PUBLISH RESULTS — 14
- Document process and study results
- Incorporate all comments and implementation actions
- Distribute Final VA Report
- Distribute electronic report to HQ VA Branch
- Update VA Study Summary Report (VASSR)
- Provide HQ the Final VA Report in pdf format

CLOSE OUT VA STUDY — 15
(if Conditionally Accepted Alternatives exist)
- Resolve Conditionally Accepted Alternatives
- Finalize VA Study Summary Report (VASSR)
- Finalize Performance Measures
- Finalize VA Report Executive Summary and provide electronically to HQ

Note: The dashed boxes indicate steps that ***may*** not be required in some VA Studies.

District 13 – Project Name

VA STUDY AGENDA

Tuesday, June 13

8:30 - 8:45	Introductions (All)
8:45 - 9:00	Brief Overview of the VA Process (VA Facilitator)
9:00 - 9:15	Remarks by Executive Director, Local COG
9:15 - 10:30	Project Overview (Project Engineers)
10:30 - 10:45	Break
10:45 - 12:30	Function Identification, Performance Criteria Development, Ranking of Baseline
12:30 - 1:30	Lunch
1:30 - 4:30	Site Visit

Wednesday, June 14

8:00 – 9:00	Recap of First Day/Review of New Information
9:00 - 10:00	Identify Observations Made on Site Visit
10:00 – 11:30	VA Objectives / Focus / Opportunities
11:30 – 12:30	Lunch
12:30 – 2:00	Function Analysis / FAST Diagram
2:00 – 3:00	Team Brainstorming
3:00 – 3:15	Break
3:15 – 5:00	Team Brainstorming

Thursday, June 15

8:00 – 10:00	Team Brainstorming
10:00 – 10:15	Break
10:15 – 12:00	Evaluation of Ideas
12:00 – 1:00	Lunch
1:00 – 4:00	Evaluation of Ideas, Assignment of VA Alternatives

Tuesday, June 20

8:00 – 9:00	Distribution/Review of Handouts from Segment 1 and VA Alternative Forms
9:00 – 12:00	Alternative Development
12:00 – 1:00	Lunch
1:00 – 5:00	Alternative Development

Wednesday, June 21

8:00 – 12:00	Alternative Development
12:00 – 1:00	Lunch
1:00 – 3:00	Meet with Technical Reviewers
3:00 – 5:00	Alternative Development

Thursday, June 22

8:00 – 12:00	Alternative Development
12:00 – 1:00	Lunch
1:00 – 4:00	Team Review of Alternatives; Grouping and Performance Ranking of Alternatives

Tuesday, August 8

8:00 – 12:00	Review of Comments on Preliminary Report; Revision of Alternatives
12:00 – 1:00	Lunch
1:00 – 4:00	Disposition Meeting with Decision Makers

Wednesday, August 9

9:00 – 11:00	Final Performance Ranking of Implemented VA Alternatives
11:00 – 12:00	Presentation Preparation
12:00 – 1:00	Lunch
1:30 – 3:30	Presentation of VA Study Results to Caltrans Management and External Stakeholders

MEETING ATTENDEES

This report section is a record of the persons who were on the VA team, assisted during the study, and attended presentation and implementation meetings. The list also includes their organizations, positions during the study, telephone and fax numbers, and e-mail addresses.

> ***Daily Attendance Sheets.*** *The example daily attendance sheet records the attendance of each person involved in each day of a study.*

MEETING ATTENDEES ***Example Project***											**Caltrans**		
2000								**NAME**	**ORGANIZATION**	**POSITION**	**TELEPHONE**		**FAX**
June						**August**					**E–MAIL**		
13	**14**	**15**	**20**	**21**	**22**	**8**	**9**						
X	X	X	X	X	X	X	X	Ginger Adams, CVS	Value Management Strategies, Inc.	VA Team Leader	760	555-3012	555-5571
											Ginger@vms-inc.com		
X	X	X	X	X	X	X	X	Mark Creveling	Simon Wong Engineering	Bridge Engineer	858	555-3113	555-6844
											mark@simonwongeng.com		
X	X	X	X	X	X	X	X	Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	760	555-3495	555-3490
											frasereng@aol.com		
X	X	X	X	X	X	X	X	Meg Williams	City of South Paseo	Principal Planner	805	555-3970	555-6565
											meg@prcity.com		
X	X	X	X	X	X	X		Steve Dennison	Regional Transportation Agency	Planning Program Manager	805	555-4662	555-5703
											sdennison@slocog.org		
X	X	X	X	X	X	X	X	Terry Hodges	Caltrans	Traffic Operations	805	555-3664	555-3045
											Terry _Hodges@dot.ca.gov		
X		X	X	X	X	X	X	Jeff West	Caltrans	Design	805	555-3393	555-3480
											Jeff_West@dot.ca.gov		
X	X		X	X	X	X	X	Mary E. Campbell	Local Transportation Committee	Chairperson	805	555-2888	
											mec@thegrid.net		

Final Report Organization

FINAL VA REPORT CHECKLIST

The following checklist guides the VA Team Leader through all of the items contained in the VA Study Report. It is organized in the order of the printed report. However, it is helpful to complete the items in reverse order so that the Executive Summary is written last, after the balance of the report is completed.

Report Front Material

- ☐ Table of Contents
- ☐ Front Cover, Edge and Back Cover
- ☐ Divider Tabs
- ☐ Cover Letter
- ☐ Final Value Analysis Study Report Structure and Content
- ☐ Distribution List

Executive Summary

- ☐ Synopsis
- ☐ Introduction with EA Number(s) and Purpose of VA Study
- ☐ Project Description Summary
- ☐ Project Issues Summary
- ☐ Project Analysis Summary
- ☐ VA Study Results
- ☐ Performance and Value Improvements
- ☐ Rating Rationale – Accepted Alternatives
- ☐ Performance Rating Matrix – Accepted Alternatives

VA Study Summary Report

- ☐ VA Study Summary Report Introduction
- ☐ Completed VA Study Summary Report

VA Alternatives

- ☐ Summary of VA Alternatives
- ☐ VA Alternatives Documentation

Project Analysis

- ☐ Project Analysis Summary
- ☐ Project Issues
- ☐ Site Visit Observations
- ☐ Cost Model or Summary
- ☐ Function Analysis/FAST Diagram
- ☐ Performance Criteria Matrix (Including Definitions and Rating Scales)
- ☐ Performance Rating Matrices (All)
- ☐ Highway User Life Cycle Benefit-Cost Analysis

Project Description

- ☐ Introduction
- ☐ Project Description
- ☐ Information Provided to the VA Team
- ☐ Document Review (If Applicable)
- ☐ Key Drawings
- ☐ Project Cost Estimate

Idea Evaluation

- ☐ Idea Evaluation
- ☐ Idea Evaluation Forms

Value Analysis Process

- ☐ Value Analysis Process
- ☐ Caltrans Project Performance Measurement
- ☐ Caltrans VA Activity Report
- ☐ VA Study Agenda
- ☐ Meeting Attendees

FINAL REPORT OUTLINE

The VA Study Report is prepared following each study in accordance with the standards outlined in this VA Report Guide. The Team Leader is primarily responsible for gathering the documentation generated during the study and compiling it systematically into a report to the Project Manager following the study. The VA Team Guide is a companion volume used to facilitate the development of documents prepared by the VA team.

Two VA Study Reports are published: the Preliminary VA Study Report, approximately two weeks after completion of Segment 2 of the VA study, and the Final VA Study Report, published after completion of Segment 3 (Implementation Meeting).

The VA Study Report is organized in sections, preceded by a cover letter, distribution list, and Table of Contents. The Final VA Study Report includes:

- **Executive Summary** — Provides an updated overview of the project, the VA alternatives and implementation decisions, and the VA Study Summary Report.
- **VA Study Summary Report** — Provides summary lists of study parameters and participants, proposed alternatives with cost and performance impacts, accepted and conditionally accepted alternatives with cost and performance impacts, and study benefits.
- **VA Alternatives** — Documents the individual VA alternatives.
- **Project Analysis** — Summarizes the findings of the value analysis of the project.
- **Project Description** — Narrative of the project scope and cost that formed the basis for the VA Study.
- **Idea Evaluation** — Lists all of the creative ideas and their evaluations.
- **Value Analysis Process** — Summarizes the VA Job Plan, performance measures process, agenda, and participants.

Preparing a thorough VA Study report is essential to clearly communicate the results of the VA Study to the stakeholders and designer as the first step in their implementation.

The report is a transcription of the handwritten work of the VA team members, is kept in electronic and hard copies, and it is bound in report documents for use by the PDT, stakeholders, and decision makers.

PRINTING AND BINDING

The VA Study Report is printed one-sided to accommodate the variety of technical information included in the VA alternatives.

The Final VA Study Report is bound in three-ring binders, with color covers and preprinted divider tabs to separate the report sections.

Cover Pages. *The example cover pages for the report include:*

- ***Front, Edge and Back Covers*** *– Standardized format prepared by the reporting organization, to identify the study project, including project EA numbers*

For the final report, the covers are printed in color.

Value Analysis Study Report

SR 64 Widening
South Paseo, California

13-3917U0-NCA-64-KP 51.8/80.8 (Western Section)
13-39580K -NCA-64-KP 80.8/90.0 (Eastern Section)

Contract No. 53A0020
Task Order No. 115

August 2000

Prepared by

VMS
Value Management Strategies, Inc.

Value Analysis Study Report

SR 64 Widening

CALTRANS DISTRICT 13 – SOUTH PASEO, CALIFORNIA

53A0020
TO 115

August
2000

COVER LETTER – FINAL

The final cover letter, with the same distribution list used with the preliminary report, accompanies the Final VA Study Report.

Final Cover Letter. *The example final cover letter is a formal transmittal of the final VA Study report.*

Final Value Analysis Study Report Structure and Content. *This is included to assist the reader to understand the organization and content of the Final VA Study Report. Key definitions are also included.*

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: **All Recipients of Final Value Analysis Report for SR 64 Widening Project**

Date: August 15, 2000
File: 303

From: **DEPARTMENT OF TRANSPORTATION**
Division of Design
Mail Stop #28

The VA Branch is pleased to transmit this Final Value Analysis Study Report for the referenced project. To assist the reader in using this report, the organization and content of this report, as well as key definitions used in the VA Study Report, are described on the following pages.

These copies are intended for individuals shown on the distribution list at the front of the report. Please distribute these copies as soon as possible.

This concludes the VA Study activities for this project.

OR

The only activity remaining on this VA Study is follow-up with _____ at the appropriate time regarding the conditionally accepted VA alternatives.

If you have any questions or comments concerning the final report, please contact me at _____.

Sincerely,

Final Value Analysis Study Report Structure and Content

PURPOSE OF REPORT

To improve reader understanding of the VA Study Report, information relating to the organization of the report is provided. Key definitions are also provided. The Final VA Study Report is circulated to the same parties who received a copy of the Preliminary VA Study Report. The Final Report documents changes made as a result of the comments received on the preliminary report, implementation decisions related to alternatives, and if appropriate, follow-up activities required to close out the VA activities. In addition, key project information analysis that was integral to the development of the VA alternatives is included in this document.

A GUIDE TO READING THIS REPORT

The Final VA Study Report includes:

- **Transmittal Letter** — Letter from the VA Study Facilitator transmitting the report.
- **Distribution List** — List of the recipients of the Final Report.
- **Executive Summary** — Overview of the project and the results of the VA Study.
- **VA Study Summary Report** — Database format summary used by the Caltrans VA Program Administrators for auditing and reporting purposes.
- **VA Alternatives** — Documentation of the individual VA alternatives, which suggest modifications to current design concepts.
- **Project Analysis** — Documentation of the findings of the value analysis of the project.
- **Project Description** — Narrative of the project scope and cost that formed the basis for the VA Study.
- **Idea Evaluation** — List of all the creative ideas and their evaluations.
- **Value Analysis Process** — Description of the VA methodology employed by Caltrans, the study agenda, and participants.

The **Transmittal Letter** serves to close out the VA Study, or to document follow-up actions needed to close it out.

The **Report Structure and Content** information is provided to assist reader understanding of the VA Report. The purpose and content of each section and key definitions are provided.

The **Distribution List** is provided to document the individuals who received copies of the Final Report.

The first page of the **Executive Summary** provides a "Synopsis", a *very brief* summary of the VA Study and results. The Executive Summary itself elaborates on the Synopsis, providing brief descriptions of the project, issues associated with the project, the findings resulting from using the VA tools to analyze the project, and a summary of the key VA alternatives produced. Performance ratings, developed by the VA team and decision-makers for the accepted VA alternatives, are presented, along with the rationale for those ratings.

The **VA Study Summary Report (VASSR)** is a database-format summary of study participants, activities, and results. It provides lists of VA alternatives proposed, accepted, and/or conditionally accepted, along with the cost and performance impacts of each alternative listed. Study costs and benefits are summarized on the last page of the VASSR.

The **VA Alternatives** section presents in detail, with sketches, performance measures, assumptions and calculations, and cost estimates. Each VA Alternative includes a completed "Implementation Action" form, which documents reasons for implementation decisions, and validation of cost and performance impacts.

The **Project Analysis** section goes into some detail about the VA tools used by the VA team to analyze the project, and discusses the results of those analyses.

The **Project Description** section elaborates on the scope of the project studied, and provides a copy of the project cost estimate used by the VA team.

The **Idea Evaluation** section provides the reader with a list of the ideas generated by the VA team, how each idea was evaluated and ranked, and understand why certain ideas were not developed.

The **VA Process** section describes the Caltrans VA Methodology. It includes detailed descriptions of the activities included in the VA Study process, with special emphasis on the performance measures process used by Caltrans. A copy of the VA Study Agenda and the Meeting Attendance list are also provided.

Definitions of **Key Terms** used in VA Study Reports are listed below:

Original Concept is the design solution that is used as the baseline for the VA Study. This can be either one of the PSR, PSSR alternatives or the PS&E design, depending on the point in time that the VA Study is being performed. The VA analysis, proposed changes, and cost and performance potential changes are all referenced against the original concept.

VA Alternative(s) are developed by the VA team as items to be considered as alternatives to either replace or enhance elements of the original concept.

Performance Measurement is a unique methodology developed by the Caltrans VA Program to measure the effectiveness of the project scope of various alternatives. This permits the interrelationship between cost and performance to be quantified and compared in terms of how they contribute to overall value.

Value Analysis Study Summary Report (VASSR) is a seven-page form, structured for database input and used by the Caltrans VA Program Administrators for auditing and reporting purposes. The VASSR includes key project information and documents cost and performance changes for each alternative and set that is proposed, accepted, and conditionally accepted. The study reportable statistics results are also summarized in this document.

Initial Cost refers to the costs for construction, right-of-way, and support that are expended to complete the project and have it open to traffic.

Subsequent Cost refers to operations, maintenance, and other costs that are necessary to keep the facility functioning over the projected life of the project. Typically, a 20-year life is used for life cycle cost comparisons, but when structures are involved, a 50-year life expectancy is used.

Highway User Costs refer to the cost associated with the use of the facility. This includes trip time, energy costs, and accident costs. When alternatives impact one of these factors, the Highway User Cost can be calculated to quantify the differences between alternatives.

Life Cycle Costs consider all costs estimated for a facility over a designated time period (typically either 20 or 50 years) and adjusts those costs to today's dollars, so that alternatives that have different subsequent and highway user costs can be compared, to assist in determining the most cost effective solution for the project.

PID, PA&ED, and PS&E

The Project Initiation Document (PID) phase, Project Approval & Environmental Document (PA&ED) phase, and Plans Specifications and Estimate (PS&E) phase, are the three key design related Caltrans project delivery phases.

PID is often referred to as the "K"-Phase and includes activities to develop documents that define projects (PSR – Project Study Report and PSSR – Project Scope Summary Report), and it is required to be developed and approved before any project can be programmed and constructed on the State Highway System. Note: the PSSR is a document that satisfies the requirements for both the Project Study Report (PSR) and the Project Report (PR). It is typically used to program and approve pavement rehabilitation and seismic retrofit projects.

PA&ED is also referred to as the "0"-Phase and includes activities required to obtain project approval. The PA&ED includes activities such as Technical Studies, Draft Project Report (DPR), Project Report (PR), and Environmental Document (ED). It ends with project approval by the District Director and a ROD (Record of Decision) by the FHWA.

PS&E is also referred to as the "1"-Phase and includes those activities necessary to develop the project Plans, Specifications, and Estimates that form the basis of the contract documents that lead to a bid and award to the successful contractor.

DISTRIBUTION LIST

The distribution list accompanies the instruction letter and identifies each recipient of the VA Study Report.

Distribution List. *The distribution list directs the Final VA Study Reports to all or some of the following, as appropriate for the project:*

- *Project Design Team*
- *Functional Units*
- *Caltrans VA Team Members*
- *VA Coordinator*
- *District Management*
- *Consultant Team Members*
- *Headquarters VA Branch*
- *Local Agencies*
- *Any Other Interested Parties*

VA Study Report

Example Project

Distribution List

VA Team – Caltrans D-13 (5 Copies)

1. Terry Hodges
2. Jeff West
3. Mark Creveling
4. Wendy Weldon
5. Mike Ireland

VA Team – Non-Caltrans (4 Copies)

1. Graham Fraser, Fraser Engineering, Inc.*
2. Mary E. Campbell, Fix 64 Committee*
3. Meg Williams, City of South Paseo *
4. Steve Dennison, Local COG*

Caltrans D-13 Functional/Technical Reviewers (9 Copies)

1. Wendy O'Mally, Design
2. Tom Dallas, Project Engineer – Phases 1 & 2
3. Richard Rosella Project Engineer – Phase 3
4. Larry Bonds, Environmental
5. Bruce Patton, Construction
6. Nevin Samuels, Traffic Operations

Decision Makers (8 Copies)

1. Simon Vector, Director
2. Gregg Sampson, Transportation Planning
3. Steve Price, Traffic Operations
4. Pat Connelly, Construction
5. John Majors, Right-of-Way
6. Jorge Granola, Design

Headquarters VA Branch (1 Copy)

1. Earl Burgess*

*Distributed by Value Management Strategies, Inc.

TABLE OF CONTENTS

The Table of Contents tabulates all of the material in the report by major section and subsections. An example for the final report is shown on the following page.

> ***Table of Contents.*** *The example Table of Contents lists all report sections and sub-sections contained in the report in the sequence presented. No page numbers are given because the VA alternatives are individually paginated; however, each section of text is page numbered.*

TABLE OF CONTENTS

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8. VALUE ANALYSIS PROCESS

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VA Study
Report
Caltrans Project Performance Measurement
Caltrans VA Study Activity Chart
VA Study Agenda
Meeting Attendees

Executive Summary – Final

SYNOPSIS – FINAL

The Final Synopsis gives a backward-looking view of the study, reporting on the implemented alternatives and accepted savings.

Final Synopsis. *The example Synopsis – Final shows changes to the Preliminary Synopsis as follows:*

- ***VA Alternative Set*** *– No sets are listed in the Final Synopsis. Rather, a narrative description of the cumulative effect(s) of the accepted VA alternatives is included.*

Briefly discuss the accepted alternatives and describe the benefits to the project resulting from the accepted alternatives. *Note how many alternatives were accepted, and the total cost and performance impacts of the accepted alternatives. If conditionally accepted VA alternatives remain, briefly discuss these and the added benefit that they could have on the project.*

SYNOPSIS

FINAL

The proposed project consists of widening State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers.

This project is divided into two segments: Western and Eastern. The total cost of these segments is approximately $235,600,000. The VA team identified several VA alternatives that consider modified intersections, median width, roadway alignment, drainage, and the SR 14/SR 64 Interchange. The most significant VA alternatives recommended reducing the design speed in certain areas of the project.

The accepted VA alternatives reduced the project's excavation quantities by almost 70%, reduced almost a mile of existing sustained 6% grade to 4%, eliminated an existing intersection at the bottom of a sustained grade, significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on/across the highway, and reduced construction time by at least one year. The use of the interchange in lieu of the intersection eliminates the only traffic signal within the project limits. It also reduces the turning conflicts and should help to further reduce the accident rate in the area. The four accepted VA alternatives result in cost savings of $23,000,000 and performance improvement of 26%. One of the accepted VA alternatives increased initial cost $2,300,000 but reduced highway user costs by approximately $29,700,000.

One additional VA alternative was conditionally accepted, which will further reduce excavation and right-of-way impact. Acceptance of this alternative would result in additional savings of $6,000,000 with minimal performance improvement.

EXECUTIVE SUMMARY – FINAL

The Preliminary Executive Summary is modified to become the Final Executive Summary following the completion of the Implementation Meeting to document the final results of the study.

Final Executive Summary. *The example Final Executive Summary shows changes made to the following sections:*

- ***VA Alternatives*** *– VA Alternatives section becomes VA Study Results. The introductory paragraph(s) discuss the results of the study. This is followed by the VA alternatives, which are grouped by their disposition.*
  - *Summary of the alternatives that were implemented, their benefits, and the validated savings and performance of each.*
  - *Summary of conditionally accepted alternatives, their benefits, validated savings, performance of each alternative, and what action remains to be taken to finalize disposition.*
  - *Summary of rejected alternatives, with a brief explanation of the reason for rejection of each.*
- ***Performance and Value Improvements*** *– The Performance Rating Matrix is modified to eliminate the ratings previously shown for VA sets, and add the ratings applicable to the* ***accepted*** *VA alternatives. In conjunction with this change, the table describing the "Rating Rationale – Proposed Sets" is modified to reflect the effects of just the accepted VA alternatives. These values and rationales are validated at the Implementation Meeting.*
- ***VA Team and Process*** *– The list of VA team members is omitted from this section of the Executive Summary, because this information is included in the* ***VA Study Summary Report*** *section.*

EXECUTIVE SUMMARY **FINAL**

INTRODUCTION

This Value Analysis (VA) Report summarizes the events of the VA Study conducted by Caltrans District 13 and facilitated by Value Management Strategies, Inc. The subject of the study was the SR 64 Road Widening in NCA County, California:

- 13-3917U0-NCA-64-KP 51.8/80.8 (Western Section)
- 13-39580K-NCA-64-KP 80.8/90.0 (Eastern Section)

The VA Study was intended to focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders.

PROJECT DESCRIPTION

The proposed project will widen State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. The Western Section is funded through construction, and the Eastern section is funded through the environmental process. The current estimate of $235,600,000 for the total project significantly exceeds available funding.

PROJECT ISSUES

The following are some of the issues and concerns associated with the widening project:

- Approximately 80% of excavation in the Western Section is in a one-mile segment at the Solitude Grade.
- Chandler Creek crosses the roadway several times in the Western Section.
- A roadside rest in the Western Section will require overcrossings or an interchange, unless another rest area is constructed on the opposite side of the highway.
- The Eastern section must deal with significant utility relocations, including oil pipelines.
- The interchange at SR 14/SR 64 must avoid wetlands to the south and east, and the San Andreas Fault to the west.
- Design exceptions will be required in select areas to be able to use a design speed lower than 130 km/h.
- Environmental impacts include vernal pools, wetlands, wildlife habitats, potential for hazardous waste, and some historic considerations.

PROJECT ANALYSIS

The VA team analyzed the project using the Value Analysis tools and job plan.

Using function analysis and Function Analysis System Technique (FAST) diagramming, the team defined the basic function of this project as *Improve Safety*. Key secondary functions include *Separate Traffic, Accommodate Speed Differential,* and *Improve Sight Distance.* Analysis of the functions intended to be performed by the project helped the team focus on the purpose and need of the project and, consequently, how to craft alternative concepts that would provide the required functions.

Specific performance criteria were developed in cooperation with the designers and stakeholders. These criteria were weighted, using a paired comparison approach, and resulted in the criteria used to evaluate ideas and alternative concepts. These criteria are identified later in this section under the heading Performance and Value Improvement.

Approximately 60% of the estimated project costs are for earthwork and structural section work; almost half of those costs are contained in the Western Section. Structures account for more than 20% of the project cost. Rising costs of asphalt and excavation work contribute significantly to the difference between the current project estimates and those contained in the original PSR documents for the Western and Eastern sections.

Based on the current project estimates, the Highway User Benefit Cost Models show payback periods of seven years for the Western Section, and five years for the Eastern section.

VA STUDY RESULTS

Four VA alternatives were accepted, resulting in cost savings of $23,000,000 and performance improvement of 26%. One of the accepted VA alternatives increased initial cost $2,300,000 but reduced Highway User Costs by approximately $29,700,000. The alternatives reduced the project's excavation quantities by almost 70%, reduced almost a mile of existing sustained 6% grade to 4%, eliminated an existing intersection at the bottom of a sustained grade, significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on/across the highway, and reduced construction time by at least one year. The use of the interchange in lieu of the intersection eliminates the only traffic signal within the project limits. It also reduces the turning conflicts and should help to further reduce the accident rate in the area.

One additional VA alternative was conditionally accepted, which will result in additional savings of $6,000,000 when approved. This alternative will also further reduce excavation and right of way impacts.

Accepted Alternatives

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
1.2	**Realign SR 64 Southbound and Reroute Solitude Road**	($16,383,000)	+3%

This concept retains the 4% grade in the baseline design, reduces the design speed at horizontal and vertical curves from 130 km/h to 110 km/h, reduces the 18.6-meter median to 13.8 meters, and reroutes Solitude Road under the new Solitude Bridge to Wiley Road. This reduces right-of-way requirements, reduces environmental impacts, and improves local access in this section of the highway.

3.0	**Steepen Slopes to 1.5:1**	$6,420,000	+5%

This alternative results in cost savings, as well as a slight improvement in project performance. The concept reduces earthwork, decreases export, and decreases the amount of right-of-way required.

5.0	**Go Around Oil Refinery; Realign Roadway to Intersect Utilities at 90°**	$1,011,000	+3%

This alternative alignment would place the highway further north to avoid the oil refinery pumping plant and cross the Chevron pipelines rather than overlap them. Although it adds right-of-way requirements, it significantly reduces the cost of relocating utilities and reduces environmental impacts to the riverbed south of the refinery.

8.0	**Undercrossing at Olive Hill Road with Interchange**	($1,982,000) *$34,146,000*	+15%

This alternative results in a significant improvement to traffic operations on the mainline by providing grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center, providing good access and visibility. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area. Highway User Savings of $29,700,000 will result from this change.

Conditionally Accepted Alternatives

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
4.1	**Reduce Design Speed to 120 km/h in Selected Areas**	$6,000,000	+3%

This alternative recommends lowering the design speed to 120 km/h, or varying the speed to 120 km/h at Solitude, Continental, and Chandler Creek. The concept shortens the design radius of horizontal curves and shortens the length of vertical curves, as well as providing greater flexibility in design around obstructions and existing topography. Project performance would be slightly increased, and significant cost savings may be achieved.

The Project Manager has formally requested the design exception from Headquarters. Approval is expected by May 2002.

Rejected Alternatives

Alt. No.	Description	Reason for Rejection
1.1	Relocate/Consolidate/Improve At-Grade Intersections.	Rejected in favor of Alternative 1.2
1.3	Eliminate Wiley Drive Connection	Rejected in favor of Alternative 1.2
2.1	Design Median Width for Projected Traffic Volumes	Circumstances do not warrant a design exception for this change.
2.2	Reduce Solitude Grade Median to 7 Meters with Concrete Barrier for ~1,000 Meters	Maintenance would be more difficult, and the savings do not warrant sight distance problems that might be created.
4.2	Lower Design Speed to 110 km/hr in Selected Areas	Rejected in favor of Alternative 4.1.
6.1	Relocate 14/64 Interchange Beyond the Wetlands	Does not avoid all of the environmentally sensitive areas, and requires realignment of both SR 14 and SR 64.
6.2	Design Simple Flyover at the 14/64 Interchange	Could necessitate realignment of both SR 14 and SR 64.
7.0	Eliminate Asphalt Treated Permeable Base and Edge Drains	Project does not meet the criteria for elimination of the edge drains.

Detailed documentation of all the VA alternatives is provided in the VA Alternatives section of this report.

PERFORMANCE AND VALUE IMPROVEMENTS

Performance measures are an integral part of the Caltrans VA process. It is important that they are well defined and agreed to by the stakeholders at the start of the VA Study, as they are used throughout the study to identify, evaluate, and document alternatives. They are also used to report performance and value improvements at the end of the VA Study.

When implementation decisions were concluded, the PDT evaluated the overall project with the accepted alternatives incorporated. Comparing the ratings, score, and value index for this group of alternatives to the baseline designs enabled the PDT to determine the relative improvements to the project that result from the VA alternatives.

The rationale for changes in performance and value of the accepted alternatives and the Performance Rating Matrix follow. More detail on the performance measures process is included in the VA Process section of this report.

Rating Rationale – Accepted Alternatives

Performance Criteria	Rationale
Mainline Traffic Operations	Improvement is primarily due to elimination of the only traffic signal on SR 64 within the project limits that resulted from converting the signalized intersection to an interchange.
Highway User Safety	Addition of the interchange and elimination of turning movements into the commercial areas at this location will reduce the conflicts that have been the primary source of a number of accidents in this area. Reduced almost a mile of existing sustained 6% grade to 4%. Eliminated an existing intersection at the bottom of sustained grade. Significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on or across SR 64. Improved sight distance by using Wiley Road intersection and a flatter curve.
Access	Elimination of traffic signal and replacing it with an interchange will improve accessibility to the area where a new industrial park is planned.
Local Traffic Operations	No significant change.
Constructibility	Reduction in excavation quantities of >2 million m^3. This is made possible by the reduction in design speed. The interchange at Olive Hill Road does not complicate construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are avoided.
Right-of-Way Impacts	Significant reduction in the right-of-way requirements. Eliminates most building takes and reduces the need for new frontage roads.

In the event that any conditionally accepted alternatives are accepted at a later date, the overall performance impact of the VA alternatives will be reevaluated.

PERFORMANCE RATING MATRIX - Accepted Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		Accepted Alts.									9		216
Highway User Safety	29	Original Concept						6					174
		Accepted Alts.									9		261
Access	19	Original Concept							7				133
		Accepted Alts.								8			152
Local Traffic Operations	10	Original Concept							7				70
		Accepted Alts.								8			80
Constructibility	2	Original Concept							7				14
		Accepted Alts.								8			16
Environmental Impacts	14	Original Concept						6					84
		Accepted Alts.								8			112
Right-of-Way Impacts	2	Original Concept					5						10
		Accepted Alts.								8			16

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
Accepted VA Alternatives (1.2, 3.0, 5.0, 8.0)	853	26%	214.9	3.97	38%

VA Study Summary Report

VA STUDY SUMMARY REPORT

The VA Study Summary Report (VASSR) is used by the Caltrans VA Program Administrators for auditing and reporting purposes. The summary report is filled out portion-by-portion as the VA Study progresses, and it is submitted as part of the Final VA Study Report. The information in the VASSR is preliminary if conditionally accepted VA alternatives are noted. When the conditionally accepted VA alternatives are resolved, the VASSR is modified to show the final results of the VA Study.

VASSR. *The example VASSR is comprised of seven sections:*

- ***Task Order Identification*** *– Provides basic information that identifies and describes the project, the need and purpose for the project, and the purpose of the VA Study.*
- ***Participants and Schedule*** *– Identifies the VA team, other key study participants, and a schedule of key events.*
- ***Proposed Alternatives*** *– Lists all VA alternatives with their potential cost, performance, and value changes, and establishes sets of alternatives to show how the alternatives can fit together into a solution for the project.*
- ***Accepted Alternatives*** *– Lists accepted VA alternatives with their validated cost, performance, and value changes, and their total impact on the project.*
- ***Conditionally Accepted Alternatives (Page 1)*** *– If there are unresolved conditionally accepted VA alternatives, they are listed on this page with their potential cost, performance, and value changes, and their total impact on the project.*
- ***Conditionally Accepted Alternatives (Page 2)*** *– Details the potential impact of conditionally accepted alternatives on the performance rating of the accepted alternatives, how much the performance rating changes for each criterion, and the rationale for that change.*
- ***Benefits*** *– Provides information related to VA Study costs, VA alternative acceptance rate, return-on-investment calculations, and a narrative of the VA Study benefits.*

VALUE ANALYSIS STUDY SUMMARY REPORT

INTRODUCTION

The Value Analysis Study Summary Report (VASSR) is a seven-page form used by the Caltrans VA Program Administrators for auditing and reporting purposes. The summary report is filled out portion-by-portion as the VA Study progresses, and it is submitted as part of the Final VA Study Report. If there are conditionally accepted alternatives after the Implementation Meeting, the VA Team Leader will follow-up with the Project Manager and District Value Analysis Coordinator (DVAC) on a regular basis to conclude the VA Study. Once the dispositions of the conditionally accepted VA alternatives are finalized, the VASSR and Executive Summary are updated and provided to the Caltrans HQ VA Branch for reporting in the Annual VA Program, and the VA Study activities are completed. The information in the VASSR is preliminary if conditionally accepted VA alternatives are noted. When the conditionally accepted VA alternatives are resolved, the VASSR will be modified to show the final results of the VA Study.

The VASSR includes:

VASSR – Task Order Identification: The Project Manager and DVAC originally developed this page to initiate the project. It provides basic information to identify the project, a narrative description of the project, the need and purpose for the project, and the purpose of the VA Study. The information is updated during the VA Study by the VA Team Leader.

VASSR – Participants and Schedule: This page identifies the VA team and other key participants involved in the VA Study. The schedule of key events is also listed on this page.

VASSR – Proposed Alternatives: All VA alternatives are listed with their potential cost and performance changes. The VA team establishes sets of selected VA alternatives to provide reviewers guidance and added understanding of how the alternatives can fit together into a solution for the project. The sets and their cost, performance, and value changes are listed on this page. Cost savings and cost increases are totaled separately.

VASSR – Accepted Alternatives: Accepted VA alternatives are listed with their validated cost and performance changes. The total impact of the accepted VA alternatives is determined and the cost, performance, and value changes are listed on this page. Note: The total cost or performance changes are not necessarily the sum of the accepted VA alternatives, as there may be overlapping or synergistic effects of combining certain VA alternatives. Cost savings and cost increases are totaled separately.

VASSR – Conditionally Accepted Alternatives (Page 1): If, after the Implementation Meeting, there are conditionally accepted VA alternatives, they are listed on this page and their information is summarized similar to the accepted VA alternatives. Note: The cost and performance changes associated with the conditionally accepted VA alternatives are determined with respect to the design with the VA alternatives that have already been accepted. *If there are no conditionally accepted VA alternatives, this page is deleted from the VASSR.*

VASSR – Conditionally Accepted Alternatives (Page 2): This page documents the impact of conditionally accepted alternatives on the performance rating of accepted alternatives. How much the performance rating changes for each criterion, and the rationale for that change, are detailed. This provides the necessary back-up to properly validate the performance change of any combination of conditionally accepted alternatives that may be accepted at a later date. In many cases, several years may pass before final disposition is made, and having this information well documented supports proper assessment and validation of the performance changes. *If there are no conditionally accepted VA alternatives, this page is deleted from the VASSR.*

VASSR – Benefits: This page includes information related to VA Study costs, VA alternative acceptance rate, return-on-investment calculations, and a narrative of the VA Study benefits.

VA STUDY SUMMARY REPORT TASK ORDER IDENTIFICATION	**Caltrans**
Project Name: *Example Project*	

TASK ORDER IDENTIFICATION INFORMATION

Contract	Task Order	District	County	Route	KP	EA
53A0020	115	13	NCA	64	51.8/80.8	3917U0
			NCA	64	80.8/90.0	39580K

STUDY TYPE

Highway	X	**Process**		**Product**	
NHS Mandated?	Y				

ANNUAL VA PROGRAM

Study listed on District VA Annual Program? (Y/N)	Y

KEY PROJECT MILESTONE DATES

M000	**Identify Need:**	June 1998	**M100**	**Approve DPR:**	December 2002
M010	**Approve PID:**	April 1999	**M200**	**PA&ED:**	October 2003
M015	**Program Project:**	July 1999	**M380**	**Project PS&E:**	March 2006
M020	**Begin Environmental:**	August 2000	**M500**	**Approve Contract:**	October 2006

PROJECT DESCRIPTION

The project will widen SR 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of SR 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. Phase 1 (Western Section) is funded through construction, and Phase 2 (Eastern section) is funded through project approval. At Olive Hill Road there is a signalized intersection that will be upgraded with dual left-turn lanes from the mainline. The current estimate for the total project significantly exceeds available funding.

Capital Outlay Support Costs:	$2,640,000
Estimated Right of Way Cost:	$60,387,075
Estimated Project Construction Cost:	$172,534,500

PROJECT PURPOSE and NEED

The purpose of the project as stated in the Project Initiation Document is to increase capacity, reduce congestion, enhance safety, and improve level of service.

VA STUDY PURPOSE and OBJECTIVES

The VA Study will help create new alternatives and refine existing alternatives for the environmental document. By applying the VA process before the start of the technical studies, the environmental work will be better focused. The VA Study will comply with the Federal requirement for value analysis on NHS projects. The VA team will focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders. Specific issues the team should address include cut and fill balance within each segment, widening between the river and refinery, and the impact on the river, trucks turning crossing the median especially at the rest area, and the potential to replace the box culvert with a bridge structure.

VA STUDY SUMMARY REPORT PARTICIPANTS and SCHEDULE	**Caltrans**
Project Name: *Example Project*	

TEAM LEADERS				
Name	**Organization**	**Discipline/Position**	**Phone/Email**	**Expertise Level ***
Ginger Adams	Value Management Strategies, Inc.	Team Leader	(760) 555-3012	4
VA STUDY TEAM MEMBERS				
Terry Hodges	Caltrans	Traffic Operations	(855) 555-3664	4
Jeff West	Caltrans	Design	(855) 555-3393	4
Mary E. Campbell	Local Transportation Committee	Chairperson	(855) 555-2888	N/A
Meg Williams	City Representative	Planner	(855) 555-3970	N/A
Steve Dennison	Regional Transportation Agency	Planner	(855) 555-4662	N/A
Mike Ireland	Caltrans	Construction	(855) 555-3111	3
Wendy Weldon	Caltrans	Environmental Planning	(855) 555-3118	3
John Majors	Caltrans	Right-of-Way	(855) 555-3002	3
Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	(760) 555-3495	4
Mark Creveling	Simon Wong Engineering	Bridge Engineer	(760) 555-6844	3
PROJECT CONTACTS				
Tom Dallas	Caltrans	Project Engineer	(855) 555-3240	N/A
Wendy O'Mally	Caltrans	Design Manager	(855) 555-3681	N/A
TEAM RESOURCE ADVISORS				
Scott Williamson	Caltrans	Maintenance	(855) 555-3269	3
STUDY TECHNICAL REVIEWERS				
Larry Bonds	Caltrans – District 13	Environmental Planning	(855) 555-3801	4
Sherman Stallone	Caltrans – HQ	Senior Bridge Engineer	(855) 555-8248	4
Bruce Patton	Caltrans – District 13	Construction Engineer	(916) 555-9340	4
Alex Fitzgerald	Caltrans – HQ	Traffic	(916) 555-3838	4
PROJECT DECISION MAKERS				
Nevin Samuels	Caltrans – District 13	Traffic	(855) 555-	N/A
Kim Peterson	Caltrans – South Region	Project Development	(855) 555-0971	N/A
Jorge Granola	Caltrans – South Region	Chief - Design II	(855) 555-3860	N/A

VA STUDY SCHEDULE			
Meeting	**Dates**	**Times**	**Location**
Pre-Study Meeting	May 23, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 1	June 13-15, 2000	8:00 – 4:00	D-13 Conference Room
Study Briefing (Kick Off) Mtg.	June 13, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 2	June 20-22, 2000	8:00 – 4:00	Embassy Suites
Technical Review Session	June 21, 2000	1:00 – 3:00	Embassy Suites
Presentation (End of Segment 2)	June 21, 2000	1:00 – 3:00	Embassy Suites
Implementation Meeting	August 8-9, 2000	8:00 – 4:00	D-13 Conference Room

*** VA TEAM EXPERTISE LEVELS**

Since VA Studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be mid-level to expert-level in their knowledge, tenure, and overall experience in the referenced discipline. DVACs should contact the appropriate functional managers, well in advance of the study dates, to provide to the VA team individuals with this level of expertise, and begin recruiting for the VA teams. Consequently, DVACs will contact appropriate functional managers well in advance of the Pre-Study Meeting date to ensure the early recruitment of VA team members with the highest level of expertise.

Expertise Level
4- Expert
3- Advanced
2- Mid
1- Low

VA STUDY SUMMARY REPORT PROPOSED ALTERNATIVES	**Caltrans**
Project Name: ***Example Project***	

Summary of *Proposed* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.1	$885,000	$0	$0	$885,000	+3%
1.2	$16,183,000	$0	$0	$16,183,000	+3%
1.3	$1,700,000	$0	$0	$1,700,000	+8%
2.1	$5,097,000	$0	$0	$5,097,000	0%
2.2	$1,814,000	$0	$0	$1,814,000	0%
3.0	$6,420,000	$0	$0	$6,420,000	+5%
4.1	$6,409,000	$0	$0	$6,409,000	+1%
4.2	$9,853,000	$0	$0	$9,853,000	+1%
5.0	$1,011,000	$0	$0	$1,011,000	+3%
6.1	$400,000	$0	$0	$400,000	+2%
6.2	$4,006,000	$0	$0	$4,006,000	+4%
7.0	$3,170,000	$0	$0	$3,170,000	0%
8.0	($1,982,000)	($84,000)	$34,146,000	$32,080,000	+15%

Comments

Amount of savings estimated for Alternative 3.0 is ~$6,400,000. Actual savings could be as much as $12,000,000 to $13,000,000.

Summary of *Proposed* VA Alternatives - *Cumulative* Study Savings

VA Set No.	VA Alt. No.	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
1	1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0	$42,296,000	$0	$34,146,000	$74,376,000	+26%	+52%
		($1,982,000)	($84,000)	$0			
2	1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0	$45,740,000	$0	$34,146,000	$77,820,000	+24%	+52%
		($1,982,000)	($84,000)	$0			

Comments

Alternative 2.1 reduces median width to meet the expected road use - a divided highway, not an expressway.

Alternative 2.2 reduces the median width locally to reduce the impacts of large cuts.

VA STUDY SUMMARY REPORT ACCEPTED ALTERNATIVES	**Caltrans**
Project Name: ***Example Project***	

Summary of *Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.2	$16,000,000	$0	$0	$16,000,000	+3%
3.0	$6,000,000	$0	$0	$6,000,000	+5%
5.0	$1,000,000	$0	$0	$1,000,000	+3%
8.0	($2,300,000)	($84,000)	$29,700,000	$27,316,000	+15%

Comments

Reduction in performance for alternative 1.2 is due to removal of one local access point.

Summary of *Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Perf.	Change in Value
1.2, 3.0, 5.0, 8.0	$23,000,000	$0	$29,700,000	$50,316,000	+26%	+38%
	($2,300,000)	($84,000)	$0			

Comments

*Indicates Set Used in Report Calculations.

VA STUDY SUMMARY REPORT **CONDITIONALLY ACCEPTED ALTERNATIVES (Page 1)**	**Caltrans**
Project Name: ***Example Project***	

Summary of *Conditionally Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
4.1	$6,000,000	$0	$0	$6,000,000	+3%

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a Design Exception is approved. The validated savings have been reduced from the proposed $6,409,000 to $6,000,000.

Summary of *Conditionally Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
4.1	$6,000,000	$0	$0	$6,000,000	+3%	+7%
	$0	$0	$0			

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a design exception is approved. The validated savings have been reduced from the proposed $6,409,000 to $6,000,000.

Follow-Up Actions for *Conditionally Accepted* Alternatives

Follow up with the Project Manager (805-555-3016) in Spring, 2002, to determine whether a design exception has been approved.

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 2)	**Caltrans**
Project Name: *Example Project*	

Impact of Conditionally Accepted Alternatives on Performance Rating

Criteria	Criteria Weight	Conditionally Accepted Alternative	Cumulative Performance Change	Total Performance Adjustment	Rationale for Performance Change
Mainline Traffic Operations	24	4.1	0	0	No significant impact
Highway User Safety	29	4.1	0	0	No significant impact
Access	19	4.1	0	0	No significant impact
Local Traffic Operations	10	4.1	0	0	No significant impact
Constructibility	2	4.1	1	2	Significantly reduces cuts and export
Environmental Impacts	14	4.1	1	14	Reduces environmental impact of significant cuts
Right-of-Way Impacts	2	4.1	1	2	Reduces significant amount of new right-of-way required

VA STUDY SUMMARY REPORT BENEFIT SUMMARY	**Caltrans**
Project Name: *Example Project*	

Cost of Performing VA Study	
Caltrans Administrative Costs	$14,400
In-House Team Members	$21,450
Consultant Team Leader	$43,061
Consultant Team Members	$11,620
Total Study Costs	$90,531

Summary of VA Study Benefits	
Accepted Implementation Rate (Accepted / Accepted + CA)	50%/67.5%
Cost Reduction, Expressed as a Percentage Accepted /Accepted + CA)	9% / 11%
Study Return on Investment (ROI) (Accepted / Accepted + CA) **Implemented Savings Divided by Study Costs (Stated as xx:1)**	254:1 / 320:1
Study Value Return on Investment (VROI) (Accepted / Accepted + CA) **(Value Improvement x 1,000,000) divided by Study Costs (Stated as xx:1)**	342:1 / 420:1
Project Delivery Time Saved (Months)	0
Project Capital Outlay Support Costs Saved ($)	($70,000)

Summary of Study Impacts

Implemented VA alternatives reduced the project's excavation quantities by almost 70%, reduced almost a mile of existing sustained 6% grade to 4%, and eliminated an existing intersection at the bottom of a sustained grade. The alternatives also significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt during construction. Construction time was reduced by at least one year. The new interchange will eliminate the only traffic signal along the corridor, which will help to improve operations. The interchange will also reduce turning conflicts in an area that has historically had a very high accident rate. It will also reduce a bottleneck along the route that will result in improving operations as traffic demands increase. The relationship between Caltrans and the local stakeholders (Regional Transportation Agency, City & Community Groups) were strengthened as they used the VA process to work together to address and resolve project concerns to the benefit of all.

VA Study Timing Impacts – General Comments

The VA Study was conducted early in the Project Approval Document Phase, before the detailed Environmental Technical Studies started. This provided the VA team maximum flexibility to develop alternatives to improve the project. There were no alternatives rejected due to timing.

VA Alternatives Rejected Due to VA Study Timing	
Alternative	**Reason**

VA Alternatives

VA ALTERNATIVES

The VA Alternatives section contains the documented VA alternatives, complete with technical and cost back-up information. All of the information is transcribed to improve legibility, facilitate communication of the study results, and enable electronic reports.

VA Alternatives. *The example VA Alternatives section introduces the VA alternatives in three sub-sections:*

- ***Introduction*** *– The results of the study are summarized.*
- ***VA Alternatives*** *– A brief explanation of the content of the alternatives.*
- ***Other Considerations*** *– This section is used ONLY IF NEEDED, and includes narrative descriptions of items beneficial to the Project Development Team, such as changes or clarification needed in project documents, errors or omissions, or "design suggestions."*

VA ALTERNATIVES

INTRODUCTION

The results of this study are presented as individual alternatives to the original concept. The VA alternative documents in this section are presented as written by the team during the VA Study. While they have been edited from the Preliminary VA Report to correct errors or better clarify the alternatives, they represent the VA team's findings during the VA Study.

The Implementation Action form at the end of each VA alternative reflects the accepted or conditionally accepted VA alternative cost and performance values. These values are summarized with the original values presented by the VA team on the VA Alternative Summary form and used in the Executive Summary and VASSR sections of the report. The individual VA alternatives are not edited to reflect cost and performance changes of the implementation dispositions. Added back-up information to support the validation of cost or performance changes may be attached behind the implementation form, if available, to document the changes.

VA ALTERNATIVES

Each alternative consists of a summary of the original concept, a description of the suggested change, a listing of its advantages and disadvantages, a cost comparison, change in performance*, and a brief narrative comparing the original design with the alternative. Sketches, calculations, and performance measure ratings are also presented. The cost comparisons reflect a comparable level of detail as in the original estimate. A life cycle benefit-cost analysis for major alternatives is included where appropriate.

The alternatives in this section are as they were originally prepared by the VA team, and any changes to the cost or performance measures are documented in the Implementation Action forms at the end of each alternative.

* Please refer to the Project Analysis section of this report for an explanation of how the performance measures are calculated.

OTHER CONSIDERATIONS

The VA team generated several design suggestions for consideration by the project development team. These items represent ideas that are relatively general in nature, and are listed below.

- Install video speed enforcement equipment and support infrastructure in the baseline design for the length of the corridor. Consider phased installation of the system, with Phase I being infrastructure installation during the highway upgrade, and Phase II being equipment purchase and placement. Pursue grant money from sources like the Office of Traffic Safety, or ITS dollars.

- Consider the use of retaining walls to avoid or reduce encroachment on environmental resources.

- Widen the roadway toward the river for less expensive right-of-way, and drive sheet pile now to contain the creek for the future. Place sheet piling generally parallel to the existing roadway in areas where the Chandler Creek could wash out highway facilities during the life of the roadway.

- Incorporate all ITS in project. Construct a four-lane expressway and install surveillance loops, CCTV, three additional CMSs, and fiber optic communication cable from the SR 14/SR 64 Interchange to an existing communication hub in South Paseo.

SUMMARY OF VA ALTERNATIVES

At the conclusion of the development phase, the VA team and Team Leader review all alternatives in preparation for their presentation to the stakeholders. The Summary of VA Alternatives form is used to list all of the team results. Alternatives are numbered sequentially (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one may be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives. The VA alternative number is independent of the original idea number.

The VA Summary in the Final Report serves as a type of index to the VA alternatives in this section. They are listed here for quick reference. As cost and performance values may change between the Preliminary and Final Study Reports due to validation of the results, both potential and validated values for cost savings and performance measures are provided.

Note: The "VA sets" included in the Preliminary Report are no longer applicable; thus, they are omitted in the Final Report. Also, there are no validated costs for the rejected VA alternatives.

SUMMARY OF VA ALTERNATIVES ***Example Project***				**Caltrans**	
Number	**Description**	**Potential Savings**	**Potential Performance Improvement**	**Validated Cost Savings Initial /** ***Highway User***	**Validated Performance Improvement**
1.1	Relocate / Consolidate / Improve At-Grade Intersections	$885,000	+3%		
1.2	Realign SR 64 Southbound and Reroute Solitude Road	$16,183,000	+3%	$16,000,000	+3%
1.3	Eliminate Wiley Drive Connection	$1,700,000	+8%		
2.1	Design Median Width for Projected Traffic Volumes	$5,097,000	0%		
2.2	Reduce Solitude Grade Median to 7 Meters, with Concrete Barrier for ~1,000 Meters	$1,814,000	0%		
3.0	Steepen Slopes to 1.5:1	$6,420,000	+5%	$6,000,000	+5%
4.1*	Lower Design Speed to 120 kph in Selected Areas	$6,409,000	+1%	$6,000,000	+1%
4.2	Lower Design Speed to 110 kph in Specific Areas	$9,853,000	+1%		
5.0	Go Around the Oil Refinery; Realign Roadway to Intersect Utilities at 90º	$1,011,000	+3%	$1,000,000	+3%
6.1	Relocate 14/64 Interchange Beyond Wetlands	$400,000	+2%		
6.2	Design Simple Flyover at 14/64 Interchange	$4,006,000	+4%		
7.0	Eliminate asphalt treated permeable base (ATPB) and edge drains	$3,170,000	0%		
8.0	Undercrossing at Olive Hill Road with Interchange	($1,982,000) *$34,146,000*	+15%	($2,303,000) *$29,700,000*	+15%

*NOTE: Alternative 4.1 is a conditionally accepted alternative.

Note: Potential Savings and Potential Performance Improvement are the original values identified by the VA team in the Preliminary Report. Validated Savings and Validated Performance Improvement are the values agreed to during the Implementation Meeting for the accepted and conditionally accepted alternatives. There are no validated costs or performance improvements for the rejected VA alternatives.

VA ALTERNATIVE DOCUMENTATION

Each VA alternative is a multi-page write-up of the developed idea or combination of ideas that were highly ranked in the evaluation phase of the study. The documentation includes graphics and calculations, as well as narrative descriptions to communicate the alternative concept without the reader having to refer to outside information. The figure on the following page illustrates the forms that are used and their sequence for a fully developed alternative, including:

♦ **Summary Description**	The original and alternative concepts, advantages and disadvantages, discussion/justification, technical reviewer comments, project management considerations, cost savings, and performance are summarized.
♦ **Sketches**	Graphics for original and alternative concepts.
♦ **Performance Measures**	Summary of non-financial benefits.
♦ **Assumptions and Calculations**	State the assumptions used to determine material quantity or unit cost changes, and show the calculations used to determine the VA alternative quantities or unit costs. The results of these calculations are then used on the Initial Cost worksheet to calculate cost totals.
♦ **Initial Costs**	Estimates of the original and alternative initial costs of project elements affected by the VA alternative.
♦ **Life Cycle Costs**	Total of initial and subsequent costs. These may include annual operational costs, future periodic maintenance costs, and highway user cost impacts.
♦ **VA Team Alternative Review**	VA team review and comments on the alternative.
♦ **VA Alternative Implementation Action**	The Implementation Action forms are completed by the Team Leader and represent the agreements made at the Implementation Meeting.

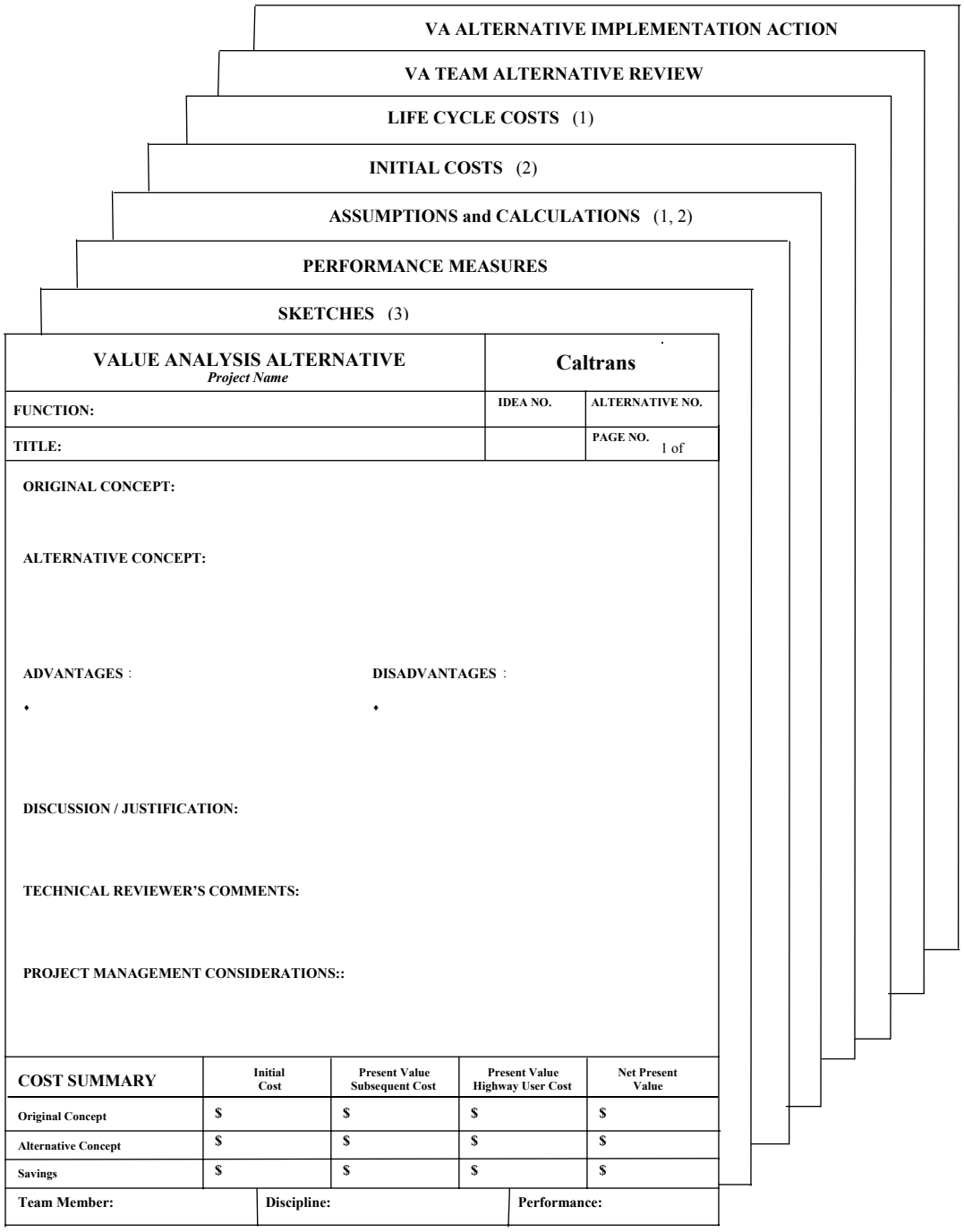
Alternatives presented in the Preliminary Report are edited in the Final Report to correct errors or better clarify the alternative; they represent the VA team's findings during the VA Study and comments from stakeholders and decision makers. This represents the final documentation of the alternatives.

Examples of each form used to document the VA alternatives follow. Refer to the VA Team Guide for information regarding how the forms are completed.

> ***VA Alternative.*** *The example VA alternative illustrates the eight pages of documentation required for an alternative. See the VA Team Guide for detailed instructions for completing these forms.*

VA ALTERNATIVE DOCUMENTATION

A complete VA alternative is a stand-alone document using the following forms:



Notes: (1) Optional, depending on needs of the alternative
(2) Additional back-up sheets may support calculations, and costs
(3) Include original and alternative sketches

VALUE ANALYSIS ALTERNATIVE *Example Project*		Caltrans	
FUNCTION: Increase Capacity		**IDEA NO.** IC-3	**ALTERNATIVE NO.** 8.0
TITLE: Undercrossing at Olive Hill Road with Interchange			**PAGE NO.** 1 of 8

ORIGINAL CONCEPT:

The original concept shows an at-grade intersection at Olive Hill Road. This intersection has a dual left-turn lane and single right-turn lane in each direction on the mainline. The intersection will be signalized to control left-turn movements. This is the only signalized intersection within the project limits.

ALTERNATIVE CONCEPT:

This alternative provides grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area.

ADVANTAGES:

- Traffic operations are significantly improved
- Maintains good access and visibility of the shopping center from the State Route
- Improves access to the residential area serviced by Olive Hill Road
- Improves pedestrian and cyclist safety crossing the State Route
- Reduces traffic conflicts that contribute to local accident concentration
- Eliminates at-grade intersection
- Reduces number of traffic lights on State Route
- Works with all alternatives in PSR
- Minimal increase in environmental impacts
- The Base Alignment already takes the majority of the businesses at the southeast corner
- Improves transition to a new county bridge over the river on Olive Hill

DISADVANTAGES:

- Increases construction cost
- Requires visual impact analysis during the environmental process
- Requires acquiring businesses at the southeast corner
- Freeway-type interchange may not match rural character
- Hook ramps are generally undesirable
- Requires dedication of 1,700 feet of existing SR 67 to the County (frontage road in front of shopping center)
- Hinders bicycle movements on the State Route; requires bicyclists to exit at Olive Hill and reenter the State Route

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	$ 1,804,000	$ 357,000	$ 34,146,000	$ 36,307,000
Alternative Concept	$ 3,786,000	$ 441,000	$ 0	$ 4,227,000
Savings	$ (1,982,000)	$ (84,000)	$ 34,146,000	$ 32,080,000

Team Member: Mark Creveling	**Discipline:** Bridge Engineer	**PERFORMANCE:** +15%

VALUE ANALYSIS ALTERNATIVE *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**ALTERNATIVE NO.** 8.0	**PAGE NO.** 2 of 8

DISCUSSION / JUSTIFICATION:

The grade separation would provide a significant improvement to traffic operations (service) on the mainline, and it would correct conditions that contribute to an above statewide average accident rate in this area. This is the main area within the entire project limits with a high accident concentration rate. This alternative maintains good access and visibility to the shopping center, which is important to the local merchants and residents. Elimination of the signalized intersection will improve local traffic circulation patterns, reduce travel delays, and reduce conflicts between residential traffic and regional truck traffic.

The State Route is a major bicycle route in the area, and the grade separation will require bicyclists to exit and reenter at Olive Hill to avoid conflicts with motorists at the on- and off-ramps. The geometrics of the ramps are based on a similar interchange recently constructed in an area with similar terrain.

The project scope improvements associated with this alternative should justify the increase in project cost.

TECHNICAL REVIEWER COMMENTS:

Environmental: This slightly increases the impact to the wetland. Added mitigation will be necessary. This should not be a major problem to the delivery of the project.

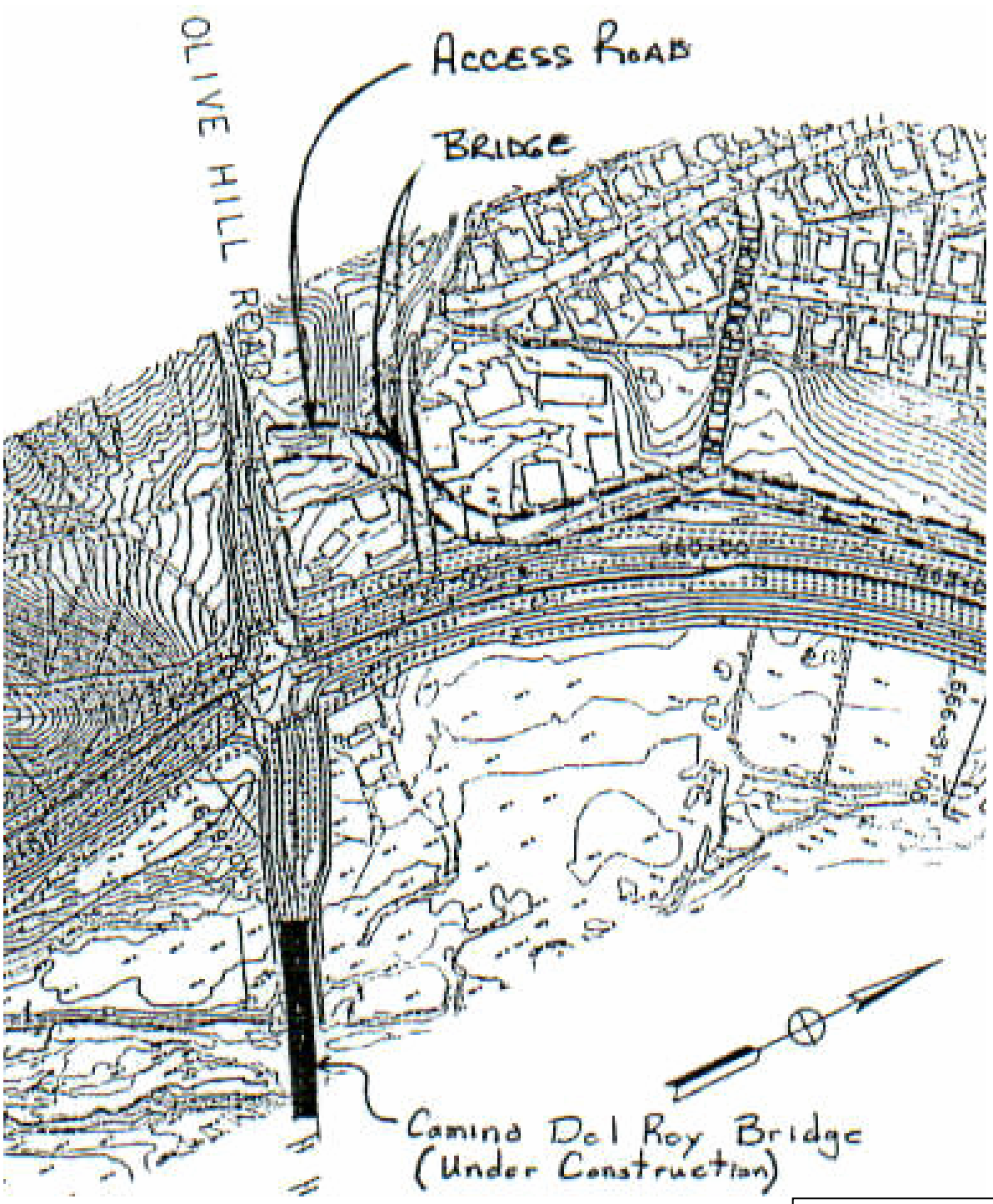
Design Reviewer: Bike traffic will need to exit and enter the State Route to avoid crossing the on- and off-ramps. This alternative should greatly improve traffic operations at this location.

PROJECT MANAGEMENT CONSIDERATIONS:

Perform a complete evaluation to accurately determine traffic benefits, costs, and the environmental impact of this alternative. This study only looked at the immediate interchange area. The alignment may have impacts beyond that need to be studied.

During the Draft PR phase, determine if a full diamond is viable at this location, and identify the cost and environmental impacts.

SKETCHES ***Example Project***	**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0	**PAGE NO.** 3 of 8



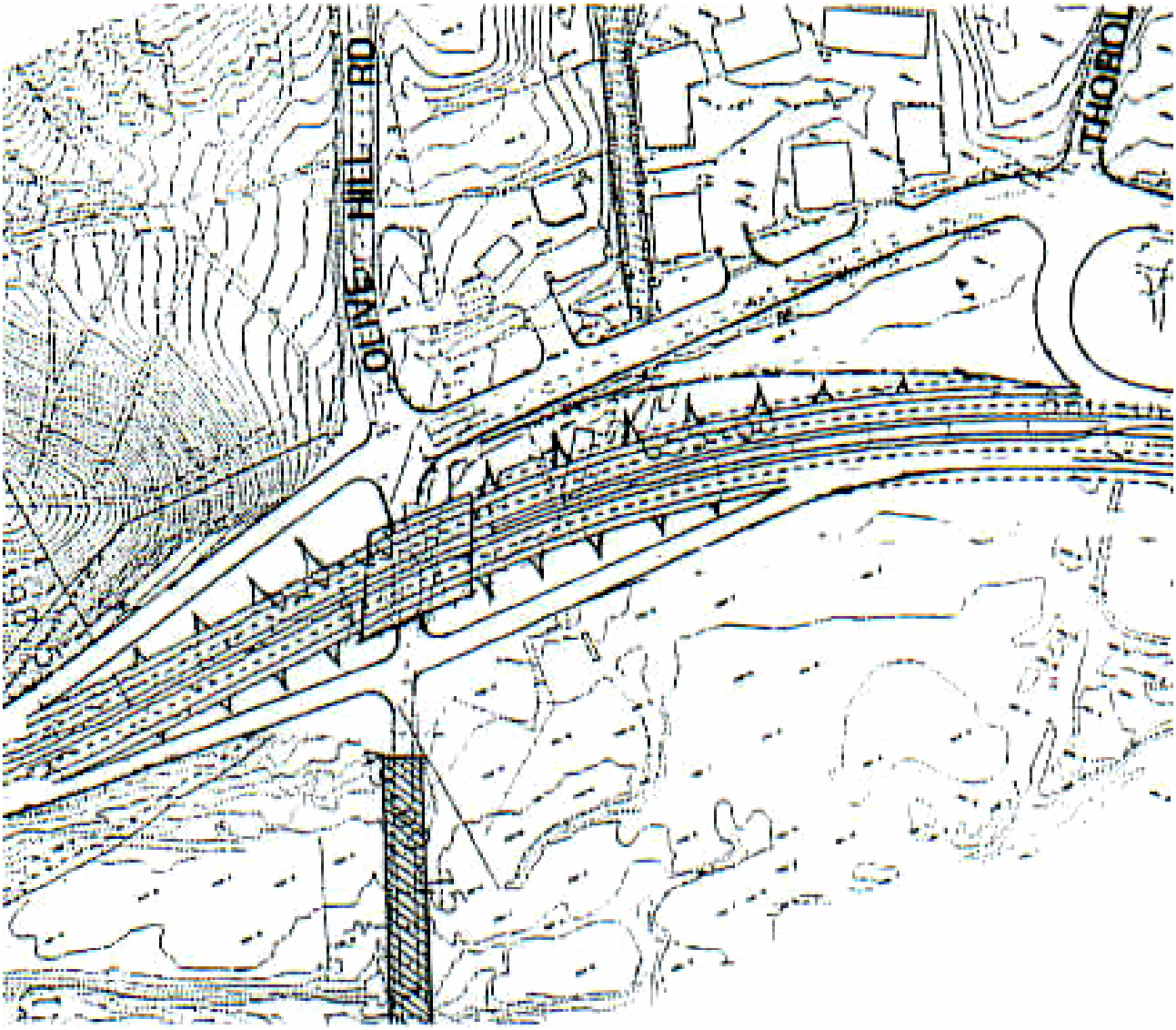
ORIGINAL CONCEPT:
At-Grade Intersection

Example

SKETCHES ***Example Project***	**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0	**PAGE NO.** 4 of 8

ALTERNATIVE CONCEPT:
Undercrossing with
Tight Diamond Interchange

Example



PERFORMANCE MEASURES ***Example Project***		**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange		**NUMBER** 8.0	**PAGE NO.** 5 of 8
CRITERIA and RATING RATIONALE for ALTERNATIVE	**Performance**	**Original**	**Alternative**
MAINLINE TRAFFIC OPERATIONS Greatly improves mainline traffic operations in this area; the traffic signal is eliminated along with slowing for turning traffic, as the on-ramps will get traffic up to speed before merging into traffic. While this is a significant improvement locally, it is a minor improvement when considering the overall project.	Rating	8	9
	Weight	24	24
	Contribution	192	216
HIGHWAY USER SAFETY Eliminates conflicts at the entrance and exit to the shopping center northeast of the intersection and associated left-turn movements—especially truck turning movements. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Rating	6	9
	Weight	29	29
	Contribution	174	261
ACCESS Maintains good local access to businesses and homes in the area.	Rating	7	7
	Weight	19	19
	Contribution	133	133
LOCAL TRAFFIC OPERATIONS Improves traffic flow on local streets, as traffic the signal is improved. Adds a side entrance to the shopping center from Olive Hill.	Rating	7	8
	Weight	10	10
	Contribution	80	80
CONSTRUCTIBILITY Grade separation increases construction time and complexity in the area. This will not impact the overall schedule, but it will increase local impact during construction.	Rating	7	6
	Weight	2	2
	Contribution	14	12
ENVIRONMENTAL IMPACTS Visual impact of grade separation needs to be evaluated. No other environmental impacts are anticipated.	Rating	6	5
	Weight	14	14
	Contribution	84	70
RIGHT-OF-WAY IMPACTS The westbound on-ramp would require added right-of-way from a market, and it would probably require a full take of the parcel that is currently planned for just a partial take.	Rating	5	4
	Weight	2	2
	Contribution	10	8
Total Performance:		**677**	**780**
Net Change in Performance:			**+15%**

ASSUMPTIONS and CALCULATIONS *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0	**PAGE NO.** 6 of 8

Design Assumptions

- Current intersection has dual left-turn lanes and a single right-turn lane in each direction with standard deceleration lanes for all turning movements. This design will be similar to the recently completed interchange on SR 87 at Wilder Road, which is about 15 miles from this location.
- The area of excavation and pavement for these turning lanes are approximately the same as the off-ramps and their shoulders for the proposed interchange.

Assumptions for Construction Cost Estimates

- Added area for on-ramps:
  12-foot lane + two 8-foot shoulders = 28 feet wide
  Length of on-ramps = ~850 feet each
  Therefore, total added area for ramps = 2 x 28 feet x 850 feet = 47,500 SF ~Say 50,000 SF
- Undercrossing = 80 feet wide and 150 feet long = 12,000 SF
- Add 10% mark-up to the undercrossing for uncertainties in geotechnical information and foundation design.

Assumptions for Life Cycle Cost Estimates

- Maintenance and inspection cost is based on $5,000 per lane mile for the area of influence, which is ~0.5 mile long.
- Alternative is increased by 1/3 to account for added area of on-ramps and overcrossing. Also increased to account for bridge inspection.
- Energy cost of traffic signals is eliminated in the VA alternative.
- Rehabilitation cost is increased by 1/6 to account for added pavement area to be rehabilitated.
- Highway User Costs are the differences based on the Caltrans Highway User Benefit Cost Model, using the following key assumptions:
  - ADT: year 1 = 55,000, year 20 = 77,000
  - Area of influence = 0.5 mile
  - Average operating speed is increased 5 mph with grade separation.
  - The accident rate in this area is over 50% higher than the statewide average at this location (3.04 per MVM). This is not expected to change significantly with the new project, as accidents relate to both the entrance/exit to the shopping center to the northeast corner of the intersection and the left-turn movement at the intersection, especially truck turning movements. Although the statewide average for a highway with a grade-separated facility is 1.0 per MVM, we are assuming 1.52 for the grade-separated alternative.
  - Truck traffic is ~9% of the total

INITIAL COSTS ***Example Project***						**Caltrans**	
TITLE Undercrossing at Olive Hill with Interchange						**NUMBER** 8.0	**PAGE NO.** 7 of 8
CONSTRUCTION ELEMENT		**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
Description	**Unit**	**Quantity**	**Cost/Unit**	**Total**	**Quantity**	**Cost/Unit**	**Total**
ROADWAY ITEMS							
At Grade Intersection	SF	64,300	$ 3.50	$225,050			$0
Signals	EA	4	$ 110,000	$440,000			$0
Access Road	SF	30,000	$ 3.50	$105,000			$0
Traffic Control	LS	1	$ 100,000	$100,000	1	$ 50,000	$50,000
Roadway Embankment	CY			$0	68,000	$ 7.00	$476,000
Ramps	SF			$0	50,000	$ 3.50	$175,000
ROADWAY SUBTOTAL				*$870,050*			*$701,000*
ROADWAY MARK-UP		*50%*		*$435,025*			*$350,500*
VA ADDED MARK-UP				*$0*			*$0*
ROADWAY TOTAL				*$1,305,075*			*$1,051,500*
STRUCTURE ITEMS							
Undercrossing (150x80)	SF			$0	12,000	$130.00	$1,560,000
Channel Bridge (30x160)	SF	4,800	$80.00	$384,000			$0
STRUCTURE SUBTOTAL				*$384,000*			*$1,560,000*
STRUCTURE MARK-UP		*30%*	*$384,000*	*$115,200*	*30%*	*$1,560,000*	*$468,000*
VA ADDED MARK-UP		*0%*	*$384,000*	*$0*	*10%*	*$1,560,000*	*$156,000*
STRUCTURE TOTAL				*$499,200*			*$2,184,000*
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition	LS			$0	1	$500,000	$500,000
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL				*$0*			*$500,000*
ENVIRONMENTAL MITIGATION ITEMS							
CAPITAL OUTLAY SUPPORT ITEMS	LS			$0	$1	50,000	$50,000
Reengineering and Redesign				$0			$0
Project Engineering				$0			$0
TOTAL				$1,804,275			$3,785,500
TOTAL (Rounded)				$1,804,000			$3,786,000
						SAVINGS	($1,982,000)

LIFE CYCLE COSTS ***Example Project***				**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange				**NUMBER** 8.0	**PAGE NO.** 8 of 8
Life Cycle Period 20 Years		Real Discount Rate 4.50%		**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST				$1,804,000	$3,786,000
Service Life-Original _____ Years Service Life-Alternative _____ Years		**INITIAL COST SAVINGS:**			**($1,982,000)**
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection				$15,000	$20,000
2. Operating					
3. Energy				$500	$0
			Total Subsequent Annual Costs:	$15,500	$20,000
			Present Value Factor (P/A):	13.008	13.008
			PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS (Rounded):	**$202,000**	**$260,000**
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original	15	300,000	0.5167	$155,010	
Rehabilitations - Alternative	15	350,000	0.5167		$180,845
Repairs - Original				$0	
Repairs - Alternative					$0
Expended Service Life - Original				$0	
Expended Service Life - Alternative					$0
Salvage - Original				$0	
Salvage - Alternative					$0
			PRESENT VALUE OF SUBSEQUENT SINGLE COSTS (Rounded):	$155,000	$181,000
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)				**$357,000**	**$441,000**
			TOTAL SUBSEQUENT COSTS SAVINGS:		**($84,000)**
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident					($32,264,000)
2. Travel Time					($2,714,000)
3. Vehicle Operating					$832,000
			TOTAL HIGHWAY USER ANNUAL COSTS:	**$0**	**($34,146,000)**
			TOTAL HIGHWAY USER COST SAVINGS:		**$34,146,000**
F. TOTAL PRESENT VALUE COST (A+D+E)				**$2,161,000**	**($29,919,000)**
			TOTAL LIFE CYCLE SAVINGS:		**$32,080,000**

VA TEAM ALTERNATIVE REVIEW ***Example Project***	**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0

Team Member: Wendy Weldon

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Luis Diaz

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Mary E. Campbell

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Need to discuss impact on bicyclists, as the State Route is a major part of the County bicycle route in this area. *The VA alternative was edited to address this comment.*

Team Member: Jeff West

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Terry Hodges

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Note as a disadvantage that the road between Thoroughbred Lane and Olive Hill in front of the shopping center will need to be transferred to the County. Sometimes the County does not want to take over these frontage roads unless we rebuild them first. *The frontage road will need to be realigned and reconstructed as part of this proposal; therefore, this will not be an issue with the County.*

VA ALTERNATIVE IMPLEMENTATION ACTION (FINAL) ***Example Project***	**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0
RESPONSES	**Prepared by:** Ginger Adams — **Date:** 07/27/00

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance:

The undercrossing concept is feasible and will be implemented in the PA&ED. The westbound off-ramp will be studied further to determine if a conventional diamond can be used at this location.

The construction of an interchange might have a greater impact on the project than indicated by the VA team; I suggest reducing the performance rating by one point each for Constructibility, Environmental Impacts, and Right-of-Way Impacts.

DISPOSITION

☑ **Accept**

☐ **Conditionally Accept**

☐ **Reject**

Validated Performance
+12%

Implementable Portions:

The concept can be implemented in full. The bridge cost for the Olive Hill Undercrossing will have to be verified by Structures in an Advance Planning Study.

If Alternative is Rejected

Was rejection due to VA study taking place too late in the project development process to implement the change?

Yes ☐ No ☐

Validated Cost Savings:

The bridge design as shown in this VA study is being reviewed as part of the APS, and preliminary estimates at a cost of $150/sf versus the $130/sf proposed by the VA team. This preliminary APS cost estimate of $2.3 million will be used. The original cost estimate has been marked up to reflect the change.

The highway user benefits savings as revised by the PDT of $29,700,000 is accepted. The change is due to a revision to the percentage of truck traffic projected for the new facility. Significant operational benefits result from this alternative.

Validated Savings
($2,300,000) Initial
$29,700,000 LCC

Project Development Support Cost Savings

($70,000)

Project Development Delivery Impact:

This will add Structures design work and project development costs for this new structure. The PA&ED phase will be extended to get the necessary geotechnical information necessary for Structures and address visual impact in the Environmental Document. *Construction phasing is expected to add time to construct the structure and maintain traffic over the original concept.*

	No Change	Reduced by	Increased by
PID	☑	Mo.	Mo.
PA&ED	☐	Mo.	2 Mo.
PS&E	☑	Mo.	Mo.
Const.	☐	Mo.	1 Mo.

Other Comments:

HQ has provided verbal approval of this concept due to the significant operational benefits it provides, but has requested that we study the full diamond interchange possibility further to see what it would take to make it work.

This alternative not only improves operations in the area, but it will be able to accommodate increased traffic demands in the future while maintaining a high level of service.

Project Analysis

SUMMARY OF ANALYSIS

The Project Analysis report section gathers together the results from the application of the VA tools used during the study and summarizes the key findings that guided the VA team's work.

The Project Analysis summary lists the VA tools used by the VA team, which may include all or some of the following:

- Project Issues
- Site Visit Observations
- Cost Models
- Function Analysis
- FAST Diagram
- Performance Criteria Matrix
- Performance Rating Matrix
- Life Cycle Benefit-Cost Analysis
- Highway User Life Cycle Benefit-Cost Analysis

Each of the tools is explained individually in this section of the report, and the results are fully documented.

> ***Summary of Analysis.*** *The example Summary of Analysis paragraph is a digest of the significant findings from these analyses. It is further condensed in the Executive Summary under the heading Project Analysis.*

PROJECT ANALYSIS

SUMMARY OF ANALYSIS

The following analysis tools were used to study the project:

- Project Issues
- Site Visit Observations
- Cost Model
- Function Analysis / FAST Diagram
- Performance Criteria Matrix
- Performance Rating Matrix
- Highway User Life Cycle Benefit-Cost Analysis

PROJECT ISSUES

The following items were identified and addressed by the VA team:

- Median width of 18.6 m is perceived to be driving costs up—consider narrowing this width where possible.
- Construction staging is challenging, especially on the Western Section.
- Excavation and asphalt costs have increased significantly since the original PSR estimates were developed in 1997 and 1998.
- Design speed throughout the corridor is planned to be 130 km/hour—in some areas design exceptions will be required for lower design speeds to accommodate curves and sight distance requirements.
- Chandler Creek crosses State Route 64 several times.
- Refinery plant location is having an effect on the roadway alignment decisions.
- The San Andreas Fault and wetlands areas are major factors affecting placement of any interchange at the east junction of State Routes 14 and 64.

SITE VISIT OBSERVATIONS

The following issues and concerns were listed by the VA team following the site visit:

- Topography (for large cuts) and stream crossings create challenges
- Drainage is an issue that must be addressed in certain project areas
- Solitude River Crossing
- Cut of the ridge at Chandler Creek
- Can alignment be shifted further north at Oil Refinery?
- Further erosion of creek on roadway at Oil Refinery
- Ownership constraints
- Utilities – unique
- Rest Area will need access from both directions of the divided roadway
- Moving Oil Refinery elements are expensive
- Basic design assumptions – median width and design speed
- Surplus export
- Hunter Ranch and golf course impact with wide median
- Trucks crossing road from working roads
- Interchange operations and environmental impact
- Majority of earthwork at Solitude to Union, Chandler Creek, and Cross Creek Vineyard
- Construction staging
- Erosion control – SWPPP
- Pipeline alignment may create a need for relocation of pipelines or realignment of roadway
- Construction timing of the three project segments will affect the method of surplus dirt disposal
- Underground storage tank may represent environmental issues (hazardous waste)
- Proximity of proposed alignment to existing red barn
- Visual quality of new roadway and associated features is important to local residents
- Proximity to building at McIntosh Road
- Parking problem – trucks currently use roadside

COST MODEL

A cost model is a synthesis of the project cost estimate, reducing often-voluminous documents to single pages, making the cost estimate for the project more readily understood. The cost model also reorders the estimated costs to highlight the significant cost drivers for a project. By gathering costs into functional descriptions, construction trade categories, or project element groupings, the VA team gains an appreciation for the high cost contributors. A Pareto analysis also helps establish priorities for further analysis.

Cost Model. *The example Cost Model may organize the project cost information in two ways:*

- ***Cost Model.*** *The costs are summarized in an order similar to that used in the original project estimate.*
- *A* ***Pareto Analysis*** *may be done to isolate the "20% of the items that represent 80% of the costs" for the project.*

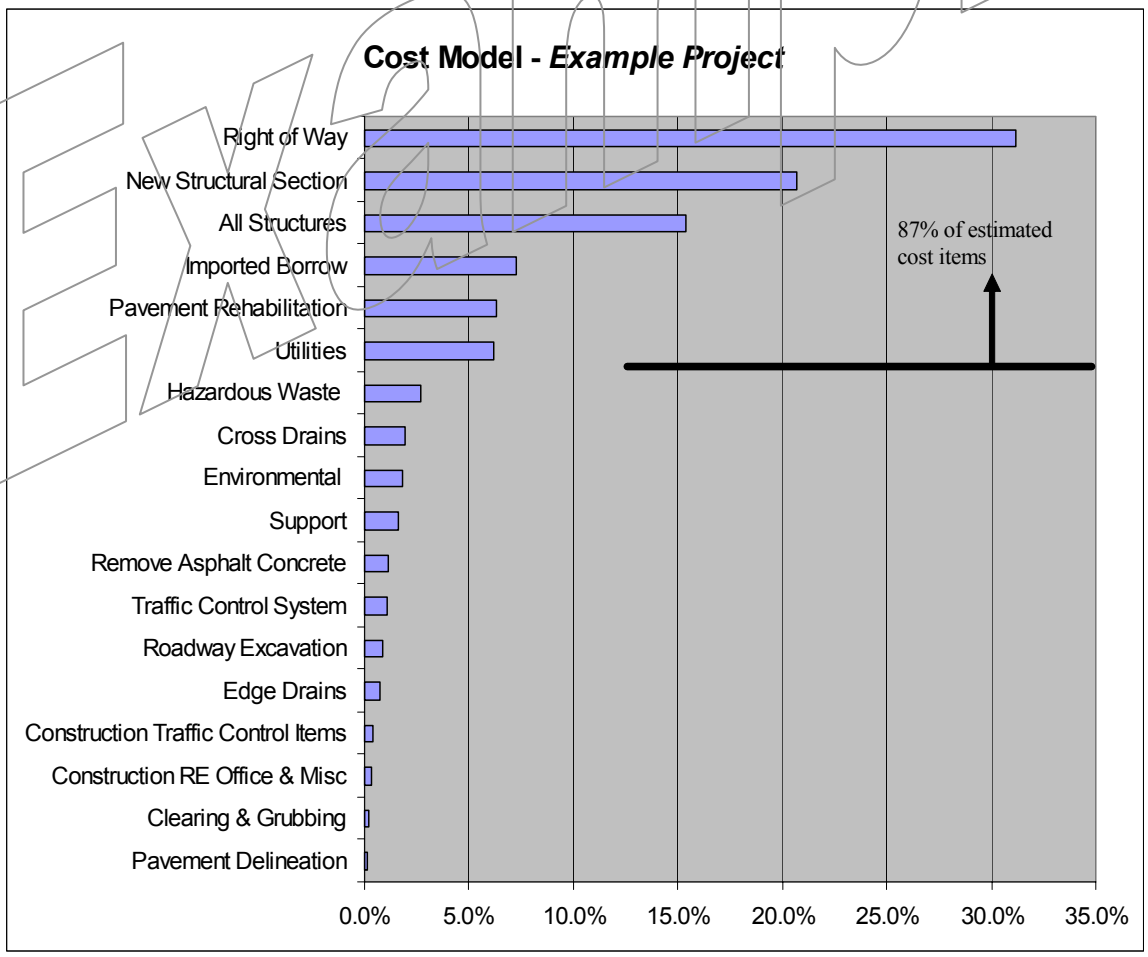
Refer to the VA Team Guide for additional information on development of Cost Summaries, Models, and Pareto Analysis.

COST MODEL

The VA Team Leader prepared a series of cost models from the designer's cost estimates. The models are organized to identify major construction elements or trade categories, the designer's estimated costs, and the percent of total project cost for the significant cost items.

The cost models clearly showed the cost drivers for the project and were used to guide the VA team during the VA Study.

- Roadway excavation costs are the biggest cost drivers in the Western Section, representing almost 15% of total costs for the overall project.
- Structures costs represent the largest cost item in the Eastern section.
- Environmental mitigation costs may be understated, since environmental studies are not yet complete.



Cost Model – Example Project

Item	Quantity	Unit	Unit Price	Cost	% of Total*
Earthwork					
Imported Borrow	780,000	M3	$15	$11,700,000	10.5%
Clearing & Grubbing	1	LS	$375,000	$375,000	0.3%
Roadway Excavation	145,000	M3	$10	$1,450,000	1.3%
Remove Asphalt Concrete	45,640	M	$40	$1,825,600	1.6%
Total Earthwork				**$15,350,600**	**13.8%**
Structural Section					
Pavement Rehabilitation	700,000	M2	$15.00	$10,186,230	9.2%
New Structural Section	1,800,000	M2	$19.00	$33,447,390	30.1%
Total Structural Section				**$43,633,620**	**39.2%**
Drainage					
Cross Drains	1	LS	$3,100,000	$3,100,000	2.8%
Edge Drains	78,000	M	$15	$1,170,000	1.1%
Total Drainage				**$4,270,000**	**3.8%**
Specialty Items					
Construction RE Office & Misc	1	LS	$554,000	$554,000	0.5%
Hazardous Waste	1	LS	$4,300,000	$4,300,000	3.9%
Environmental	1	LS	$2,981,000	$2,981,000	2.7%
Total Specialty Items				**$7,835,000**	**7.0%**
Traffic Items					
Pavement Delineation	1	LS	$259,000	$259,000	0.2%
Construction Traffic Control Items	1	LS	$637,000	$637,000	0.6%
Traffic Control System	1	LS	$1,771,000	$1,771,000	1.6%
Total Traffic Items				**$2,667,000**	**2.4%**
Subtotal				**$73,756,220**	**66.3%**
Minor Items (1)	11%	%	$73,756,220	$8,113,184	N/A
Roadway Mobilization (1)	10%	%	$81,869,404	$8,186,940	N/A
Roadway Addit. Suppl. (1)	8%	%	$90,056,345	$7,204,508	N/A
Roadway Addit. Conting. (1)	25%	%	$97,260,852	$24,315,213	N/A
Total Roadway Items				**$121,576,065**	
Structures					
All Structures	1	LS		$24,887,860	22.4%
Total Structures				**$24,887,860**	
Escalation (16.46%)	17.80%	%	$146,463,925	$26,070,579	N/A
Subtotal Construction Cost				**$172,534,504**	
Right of Way	1	LS	$ 50,387,075	$50,387,075	45.3%
Utilities	1	LS	$ 10,000,000	$10,000,000	9.0%
Support	1	LS	$ 2,640,000	$2,640,000	2.4%
TOTAL COST				**$235,561,579**	

Total cost of Estimated Items	**$111,284,080**	**100%**

(1) Percentage of Total Cost was NOT calculated for Section 6, 7, or 8 costs. Costs for items in these Sections are calculated as a percentage of Roadway Costs and are automatically affected by any changes made within that Section.

** Percentage is of theTotal Cost of estimated items*

FUNCTION ANALYSIS / FAST DIAGRAM

Function analysis results in a unique view of the purpose and goals of the study project. It transforms project elements into functions, which moves the VA team mentally away from the original design and takes it toward a functional concept of the project. Functions are defined in verb-noun statements to reduce the needs of the project to their most elemental level. Identifying the functions of the project allows a broader consideration of alternative ways to accomplish the functions.

The Function Analysis System Technique (FAST) Diagram is a logic diagram that arranges the random functions into *How? Why? When?* relationships. This diagram helps determine the basic and secondary functions, which serves to clarify the functional purpose for the whole project and elements of the project.

Once completed, project cost and performance data can be related to the functions on the FAST Diagram to identify areas where change could benefit the project. These areas become the focus for the team's creativity.

FAST Diagram. *The example FAST Diagram illustrates the arrangement of random functions into a critical logic path, and it shows costs and performance criteria associated with specific functions.*

Refer to the VA Team Guide for information regarding how the FAST Diagram is constructed.

FUNCTION ANALYSIS / FAST DIAGRAM

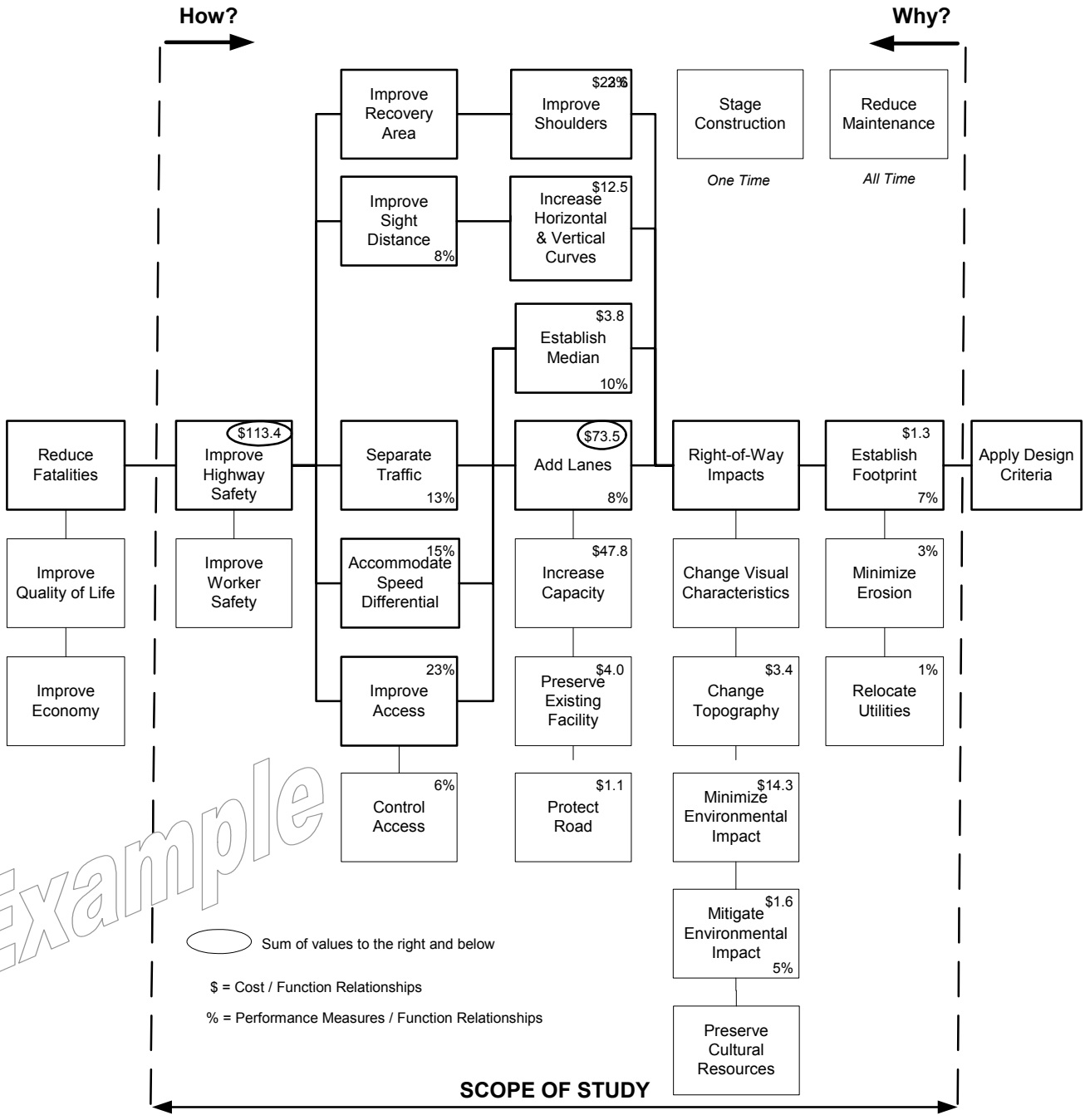
Function analysis was performed and a Function Analysis System Technique (FAST) Diagram was produced, which revealed the key functional relationships for the project. This analysis provided a greater understanding of the total project and how the issues, project cost, and function requirements are related.

The FAST diagram arranges the functions in logical order so that when read from left to right, the functions answer the question "How?" If the diagram is read from right to left, the functions answer the question "Why?" Functions connected with a vertical line are those that happen at the same time as, or are caused by, the function at the top of the column (a "When?" relationship).

The FAST Diagram for this project shows *Highway User Safety* as the basic function. Key secondary functions include *Separate Traffic* and *Add Lanes*. In several cases the project costs and performance criteria associated with the functions have been identified. This enables the team to determine the relationship between the project functions and cost, and to confirm that the performance criteria are being satisfied.

FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM

Example Project



PERFORMANCE CRITERIA MATRIX

The Performance Criteria Matrix is used to select the key evaluative criteria to be applied to the creative ideas. Candidate criteria are listed randomly, as contributed by the stakeholders, designer, and VA team. The matrix allows comparison of each criterion with all others in turn. The results give a ranking so that the top four or five criteria can be used to evaluate the creative ideas.

Performance Criteria Matrix: *The example performance criteria matrix demonstrates the results of the criteria selection and prioritization process.*

The complete list of weighted criteria is used for evaluating the developed ideas using the Performance Rating Matrix (see pages 11.19 to 11.22).

For additional information regarding the procedures used to develop the Performance Criteria Matrix, refer to the VA Team Guide.

PERFORMANCE CRITERIA MATRIX

The evaluative criteria matrix was used to determine the key evaluative criteria for the project. The VA team listed, with the assistance of the design team and stakeholders, the possible evaluative criteria that could be used to evaluate the creative ideas. These criteria were clearly defined and entered onto a matrix and compared in pairs, asking the question: "Which one is more important to the project?" The letter code (e.g., "a") was entered into the matrix for each pair. After all pairs were discussed they were tallied and percentages calculated. The highest scoring criteria were selected for use in the Evaluation Phase of the study.

The Performance Criteria Matrix is shown below. The definitions and measurement scales for each criterion are included on the following pages.

PERFORMANCE CRITERIA MATRIX ***Example Project***	**Caltrans**

								TOTAL	**%**
Mainline Traffic Operations	**A**	b	a	a	a	a	a	5.0	24%
Highway User Safety	**B**	b	b	b	b	b		6.0	29%
Access	**C**	c	c	c	c			4.0	19%
Local Traffic Operations	**D**	d	f	d				2.0	10%
Constructibility	**E**	f	e/g					0.5	2%
Environmental Impacts	**F**	f						3.0	14%
Right-of-Way Impacts	**G**							0.5	2%

a	More Important
a/b	Equal Importance

21.0	100%

After using the Performance Criteria Matrix to select the criteria, the project stakeholders and designers further refined the criteria definitions, and defined the scales to be used for each of the criteria. For this project, the performance criteria listed below were selected:

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Mainline Traffic Operations	A measure of the efficiency of traffic operations as they relate directly to the mainline alignment (including on-ramps and off-ramps) based upon a 20-year projected traffic forecast.	10	LOS "A": Volume/Capacity = 0.0–0.30; Free flow – excellent operation
		9	LOS "B": Volume/Capacity = 0.31–0.48; Stable flow – very good operation
		8	LOS "C": Volume/Capacity = 0.49–0.64; Stable flow – good operation
		7	LOS "D": Volume Capacity = 0.65–0.80; Approaching unstable flow – fair operation
		6	LOS "E": Volume/Capacity = 0.81–0.90; Unstable flow – poor operation
		4	LOS "F": Volume/Capacity = 0.91–1.05; Traffic congestion for 15 minutes to 1 hour
		3	LOS "F"; Volume/Capacity = 1.06–1.20; Traffic congestion for 1 to 2 hours
		2	LOS "F": Volume/Capacity = 1.21–1.34; Traffic congestion for 2 to 3 hours
		1	LOS "F": Volume/Capacity = 1.35 or more; Traffic congestion for more than 3 hours

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Highway User Safety	A measure of how the concept will work towards reducing not only the number of accidents, but the severity of accidents, within the project area.	10	
		9	
		8	Concept significantly improves sight distance and horizontal and vertical curve problems. Anticipated accident rate lower than statewide average for similar facility.
		7	
		6	Concept improves sight distance and horizontal and vertical curve problems. Anticipated accident rate comparable to statewide average for similar facility.
		4	
		3	Concept does not improve sight distance and horizontal and vertical curve problems that currently exist.
		2	
		1	

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Access	An approximation of a facility's degree of access (both ingress and egress) between the local roadway infrastructure and the highway system. This criterion considers how well the facility meets driver expectations, the quantity (number of on-/off-ramps), and quality (directness) of access.	10	Optimal access (i.e., all major and minor movements are provided for, and driver expectations for access are fully met)
		9	Excellent access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – one minor movement requires out-of-direction travel)
		8	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – two minor movements require out-of-direction travel)
		7	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – several minor movements require out-of-direction travel)
		6	Satisfactory access (i.e., essentially meets driver expectations; one major movement and one minor movement require out-of-direction travel)
		5	Satisfactory access (i.e., essentially meets driver expectations; several major and minor movements require out-of-direction)
		4	Marginal access (i.e., several major movements require out-of-direction travel – some minor movements are not provided)
		3	Limited access (i.e., multiple major movements are not provided and/or significant out-of-direction travel is required)
		2	Severely limited access (i.e., multiple major movements are not provided and significant out-of-direction travel is required)
		1	Unsatisfactory access (i.e., no access is provided – facility relies upon other interchanges or ramps beyond the scope of the project for access)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Local Traffic Operations	A measure of the efficiency of traffic operations as they relate to the local roadway infrastructure based upon a 20-year projected traffic forecast.	10	Optimal operations (i.e., highest level of service achievable for the facility in question – LOS "A")
		9	
		8	Good operations – traffic delays during peak hours are minimal (i.e., overall level of service equivalent to a "B")
		7	
		6	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service equivalent to a "C")
		5	
		4	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service equivalent to a "D")
		3	
		2	Unsatisfactory operations – major delays during peak hours (i.e., overall level of service equivalent to a "E")
		1	Unacceptable operations – traffic gridlock is the norm (i.e., overall level of service equivalent to a "F")

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Constructibility	A measure of how the concept will affect Caltrans' ability to construct the project, including staging considerations. A measure of how the concept will affect Caltrans' ability to construct the project, including staging considerations.	10 9	Easier to construct than baseline; staging is acceptable (no closures required).
		8 7	Not particularly difficult to construct, and staging is acceptable (no closures required).
		6	Slightly degrades ability to stage construction, and some project features more difficult to construct.
		5 4	Significantly degrades ability to stage construction.
		3	Added features will result in more difficult construction and staging.
		2 1	Cannot be constructed
Environmental Impacts	An approximation of the concept's overall effect on the surrounding environment. This criterion includes the following areas: • Water quality • Land use (such as impacts to parkland and other 4-F resources) • Endangered species (flora and fauna) • Socioeconomic resources (i.e., environmental justice)	10	Major improvement upon existing environmental conditions
		9	Minor improvement upon existing environmental conditions
		8	No environmental impacts
		7	Negligible degradation (i.e., does not require mitigation)
		6	Minor degradation (i.e., requires limited mitigation)
		5	Moderate degradation (i.e., requires significant mitigation in one area or limited mitigation in two)
		4	Moderate degradation (i.e., requires significant mitigation in two areas or limited mitigation in three)
		3	Major degradation (i.e., requires substantial mitigation in one area and limited/ significant mitigation in others)
		2	Major degradation (i.e., requires substantial mitigation in two areas and limited/significant mitigation in others)
		1	Severe degradation (i.e., requires substantial mitigation in multiple areas)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Right-of-Way Impacts	A measure of the amount and types of right-of-way required.	10	No right-of-way required for project
		9	5 or fewer parcels required; none in residential or commercial use
		8	
		7	6-10 parcels required; none in residential or commercial use
		6	
		5	5 or fewer residential and/or commercial parcels required
		4	
		3	6-10 residential and/or commercial parcels required
		2	
		1	Right-of-way difficult or impossible to obtain (e.g., Native American or military owned property)

PERFORMANCE RATING MATRIX

The Performance Rating Matrix compares competing sets of alternatives by applying the weighted performance criteria in a matrix to yield value ratios. VA alternatives are compared to the original concept for the full range of criteria to reach a judgment about their technical feasibility, as well as their acceptability to stakeholders. The matrix is essential for understanding the relationship of cost, performance, and value of the original and VA concepts.

This technique is an all-inclusive and objective means of comparing competing alternative sets; it avoids using a single criterion, such as initial cost or schedule, to judge a new concept. The Performance Rating Matrix is first developed by the VA team and is later validated by the project's decision makers and stakeholders.

Comparing the performance and cost suggests which alternatives are potentially as good as, or better than, the original concept in terms of overall value. Comparison at the value ratio level suggests which alternatives have the best functionality per unit cost, or provides the project with the "best value".

Rating Rationale – Original Concept. *Documentation of the rationale for the rating values assigned to the Original Concept.*

Performance Rating Matrix – Original Concept. *Documentation of the rating values assigned to the original (baseline) concept.*

Rating Rationale – Proposed Alternatives. *Documentation of the rationale for the rating values assigned to each VA set. VA alternative sets are developed as part of the initial analysis during the VA Study, and they are presented as possible combinations that may be considered by the decision makers. The ratings of these sets are included in this section of the Final VA Report as part of the overall documentation of the study.*

Performance Rating Matrix – Proposed Alternatives. *Documentation of the rating values assigned to the sets of VA alternatives.*

Rating Rationale – Accepted Alternatives. *Documentation of the rationale for the rating values assigned to the accepted VA alternatives.*

Performance Rating Matrix – Accepted Alternatives. *Documentation of the rating values assigned to the accepted alternatives.*

If there are unresolved conditionally accepted alternatives at the time of publishing the Final VA Study Report, two pages of the VA Study Summary Report – Conditionally Accepted Alternatives (Pages 1 and 2), are included in this section. These pages summarize cost savings and demonstrate how the alternatives would change the overall performance rating of the impacted alternatives.

- ***VA Study Summary Report – Conditionally Accepted Alternatives (Page 1)***
- ***VA Study Summary Report – Conditionally Accepted Alternatives (Page 2)***

For detailed information regarding how the Performance Criteria Matrix is developed, refer to the VA Team Guide.

PERFORMANCE RATING MATRIX

The performance rating process has been used throughout the VA Study to measure how well the various alternatives accomplish the performance criteria for the project. While the ratings for the individual VA alternatives are included with the documentation of each alternative, this section of the report includes the documentation of the performance ratings for the sets of alternatives that were developed during the VA Study.

The rationale for the ratings precedes the rating matrix for each Performance Rating Matrix developed during the VA Study. The Performance Rating Matrices included in this report document the original concepts, the proposed sets (as presented in the VA Preliminary Report), accepted alternatives, and conditionally accepted alternatives.

The following pages include:

- Rating Rationale – Original Concept
- Performance Rating Matrix – Original Concept
- Rating Rationale – VA Proposed Alternatives
- Performance Rating Matrix – Proposed Alternatives
- Rating Rationale – Accepted Alternatives
- Performance Rating Matrix – Accepted Alternatives
- VA Study Summary Report – Conditionally Accepted Alternatives (Page 1) (If necessary)
- VA Study Summary Report – Conditionally Accepted Alternatives (Page 2) (If necessary)

Rating Rationale – Original Concept

Performance Criteria	Rationale
Mainline Traffic Operations	The project upgrades a two-lane highway to a four-lane divided highway, which increases capacity. While there are numerous at-grade intersections and turning movements along this project, there is only one signalized intersection that impacts the free flow of traffic. The majority of the alignment has horizontal and vertical sight distances that meet freeway standards.
Highway User Safety	Changing the roadway from a 2-lane to a 4-lane divided highway reduces the potential for traffic accidents that currently result from passing maneuvers. There are still a number of at-grade crossings and turning movements across oncoming traffic (especially at the shopping center near Olive Hill Road). There is one high-volume signalized intersection near the shopping center.
Access	All local access points are maintained, and the quality of these access points are improved through the addition of turning pockets.
Local Traffic Operations	New signalized intersection with dual left-turn lanes from the mainline and operational improvements to other at-grade intersections will significantly reduce driver wait times to access or cross the State highway.
Constructibility	Construction is complicated by three significant cuts and construction around the refinery, due to the coordination of the oil pipeline relocations and their proximity to the creek.
Environmental Impacts	Significant mitigation is necessary due to the impact on wetlands, hazardous material expected near the refinery, and the appearance and erosion potential of the steep cuts. Habitat and Oak mitigation are necessary due to the steep cuts.
Right-of-Way Impacts	While most of the alignment is within the State's right-of-way, there are several large parcels required due to the urban intersection, large cuts, a section near the refinery, and the interchange at the east end of the project.

PERFORMANCE RATING MATRIX - Original Concept ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
Mainline Traffic Operations	24	No Build		2									48
		Original Concept								8			192
Highway User Safety	29	No Build				4							116
		Original Concept						6					174
Access	19	No Build			3								57
		Original Concept							7				133
Local Traffic Operations	10	No Build				4							40
		Original Concept							7				70
Constructibility	2	No Build											N/A
		Original Concept							7				14
Environmental Impacts	14	No Build											N/A
		Original Concept						6					84
Right-of-Way Impacts	2	No Build											N/A
		Original Concept					5						10

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	

Rating Rationale – Proposed Alternatives

Performance Criteria	VA Set 1 Reduce Design Speed to 110 kph in Selected Areas	VA Set 2 Reduce Design Speed to 120 kph in Selected Areas
Mainline Traffic Operations	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 110 kph should not have any significant impact, as the design speed is still greater than the average operating speed.	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 120 kph should not have any significant impact, as the design speed is still greater than average operating speed.
Highway User Safety	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.
Access	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.
Local Traffic Operations	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.
Constructibility	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.	Reduced cuts slightly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.
Right-of-Way Impacts	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of-way takes. Most building takes and the need for new frontage roads are eliminated.	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of-way takes and about 50% of the building takes.

PERFORMANCE RATING MATRIX - Proposed Alternatives

Example Project

Caltrans

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		VA Set 1									9		216
		VA Set 2									9		216
Highway User Safety	29	Original Concept						6					174
		VA Set 1									9		261
		VA Set 2									9		261
Access	19	Original Concept							7				133
		VA Set 1								8			152
		VA Set 2								8			152
Local Traffic Operations	10	Original Concept							7				70
		VA Set 1								8			80
		VA Set 2								8			80
Constructibility	2	Original Concept							7				14
		VA Set 1								8			16
		VA Set 2								8			16
Environmental Impacts	14	Original Concept						6					84
		VA Set 1								8			112
		VA Set 2							7				98
Right-of-Way Impacts	2	Original Concept					5						10
		VA Set 1								8			16
		VA Set 2							7				14

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
VA Set 1 (Alternatives 1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	853	26%	195.3	4.37	52%
VA Set 2 (Alternatives 1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	837	24%	191.8	4.36	52%

Rating Rationale – Accepted Alternatives

Performance Criteria	Rationale
Mainline Traffic Operations	Improvement is primarily due to elimination of the only traffic signal on SR 64 within the project limits that resulted from converting the signalized intersection to an interchange.
Highway User Safety	Reduced almost a mile of existing sustained 6% grade to 4%. Eliminated an existing intersection at the bottom of sustained grade. Significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on or across SR 64. Improved sight distance by using Wiley Drive intersection and a flatter curve. Addition of the interchange and elimination of turning movements into the commercial areas at this location will reduce the conflicts that have been the primary source of a number of accidents in this area.
Access	Elimination of the traffic signal and replacing it with an interchange will improve the accessibility to the area where a new industrial park is planned.
Local Traffic Operations	Localized improvements will result from these changes, but the overall rating will not be significantly impacted.
Constructibility	Reduction in excavation quantities of >2 million m^3. This is made possible by the reduction in design speed. The interchange at Olive Hill does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduction in design speed through the steep cut area and realignment near the river and refinery will significantly reduce environmental impacts to the project. Wetland mitigation is reduced to less than one acre. The potential to encounter contaminated soils is greatly reduced when the need to relocate old oil pipelines is eliminated. Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation is avoided.
Right-of-Way Impacts	Significant reduction in the right-of-way requirements. Eliminates most building takes and reduces the need for new frontage roads.

PERFORMANCE RATING MATRIX - Accepted Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		Accepted Alts.									9		216
Highway User Safety	29	Original Concept						6					174
		Accepted Alts.									9		261
Access	19	Original Concept							7				133
		Accepted Alts.								8			152
Local Traffic Operations	10	Original Concept							7				70
		Accepted Alts.								8			80
Constructibility	2	Original Concept							7				14
		Accepted Alts.								8			16
Environmental Impacts	14	Original Concept						6					84
		Accepted Alts.								8			112
Right-of-Way Impacts	2	Original Concept					5						10
		Accepted Alts.								8			16

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
Accepted VA Alternatives (1.2, 3.0, 5.0, 8.0)	853	26%	214.9	3.97	38%

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 1)	**Caltrans**
Project Name: ***Example Project***	

Summary of *Conditionally Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
4.1	$6,000,000	$0	$0	$6,000,000	+1%

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a Design Exception is approved. The validated savings have been reduced from the proposed $6,409,000 to $6,000,000.

Summary of *Conditionally Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
4.1	$6,000,000	$0	$0	$6,000,000	+1%	+7%.
	$0	$0	$0			

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a design exception is approved. The validated savings have been reduced from the proposed $6,409,000 to $6,000,000.

Follow-Up Actions for *Conditionally Accepted* Alternatives

Follow-up with Project Manager (805-555-3016) in Spring, 2002, to determine whether a design exception has been approved.

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 2)	**Caltrans**
Project Name: *Example Project*	

Impact of Conditionally Accepted Alternatives on Performance Rating

Criteria	Criteria Weight	Conditionally Accepted Alternative	Cumulative Performance Change	Total Performance Adjustment	Rationale for Performance Change
Mainline Traffic Operations	24	4.1	0	0	No significant impact
Highway User Safety	29	4.1	0	0	No significant impact
Access	19	4.1	0	0	No significant impact
Local Traffic Operations	10	4.1	0	0	No significant impact
Constructibility	2	4.1	1	2	Significantly reduces cuts and export
Environmental Impacts	14	4.1	1	14	Reduces environmental impact of significant cuts
Right-of-Way Impacts	2	4.1	1	2	Reduces significant amount of new right-of-way required

HIGHWAY USER
LIFE CYCLE BENEFIT–COST ANALYSIS

The Highway User Life Cycle Benefit-Cost Analysis is used to compare the project costs versus the impacts to the motoring public. The Caltrans Economic Analysis Group developed this model, based on FHWA guidelines, for assessing these user benefits. The highway users are impacted when highway design changes occur that affect user travel time and safety.

Model variables include average speed, length of route, traffic volumes, and accident rates. Current conditions are determined based on traffic studies and accident data, which are generally summarized in the Project Study Report or Project Scope Study Report. Estimates for the impact of these key variables for the various VA alternatives are developed using traffic models and/or engineering estimates. Costs include the initial costs, subsequent costs, such as maintenance/operations and rehabilitations, and any other costs associated with the facility.

Most of the input data required to run this program are part of the project documentation to be provided to the VA team. However, the traffic and accident data, as well as the maintenance and operation costs for the particular highway, may need to be found elsewhere because they are often not included in Project Reports. All other data are more readily available, are generated by the VA team during the study, or are taken from look-up tables that are part of the software.

For detailed information on the
Highway User Life Cycle Benefit-Cost Analysis Program, please visit:

http://www.dot.ca.gov/hq/tpp/offices/ote/benefit_cost.htm.

HIGHWAY USER LIFE CYCLE BENEFIT-COST ANALYSIS

A Highway User Life Cycle Benefit-Cost Analysis using a model provided by Caltrans calculates the 20-year benefits and costs of highway projects. Input data, including traffic, accident and construction, plus subsequent costs, result in calculations for travel time, vehicle operating, and adjacent savings. The net percent value and internal rate of return are used to financially evaluate highway projects.

The Highway User Life Cycle Benefit-Cost Analysis for the Road Widening Project calculates a benefit-cost ratio of 2.4 and a rate of return on investment of 16.7%. The payback period for the overall project, as designed, is 6 years.

Benefit-Cost Analyses performed on several individual VA alternatives yielded similar results, and are not reproduced in this report.

District: 5

PROJECT: Example Project

EA: 3307u0/33080k
PPNO:

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$227.1
Life-Cycle Benefits (mil. $)	$551.1
Net Present Value (mil. $)	$324.0
Benefit / Cost Ratio:	2.4
Rate of Return on Investment:	16.7%
Payback Period:	6 years

BENEFITS (mil. $)	1st Year	20 Year
Travel Time Savings	$2.6	$42.8
Veh. Op. Cost Savings	-$2.5	-$40.4
Accident Reductions	$33.8	$548.7
Emission Reductions	$0.0	$0.0
TOTAL BENEFITS	$33.9	$551.1

Value Induced Travel? (y/n) N
Default = N

Value Emissions Benefits? (y/n) n
Default = Y

Project Description

** The example project included multiple cost estimates. For purposes of this Report Guide, only one is included as an example.*

PROJECT DESCRIPTION

The Project Description section of the report presents a summary of the study project so that the reader does not have to locate other project documents to understand the scope of the VA Study. It is a digest of the project scope, schedule, and budget. Also, it includes the list of project data used by the VA team during the study, along with selected key drawings.

Project Description. *The example Project Description section includes the following topics:*

- ***Introduction*** *– Summarizes the project scope, need and purpose, schedule, and budget. List expense authorization, County, Route, and Kilometer Posts.*
- ***Project Description*** *– A narrative that describes the project as presented to the VA Team. Expands on the specific features of the project and discusses significant issues and concerns about the project scope, schedule, or budget (including type of funds). Also indicates major project elements, design speed, projected traffic (DHV and ADT), route conditions (adjacent segments and overall routes).*
- ***Information Provided to the VA Team*** *– A listing of the project data provided to the team for use during the study, noting the name of the document, the source, and the date.*
- ***Document Review*** *– If any errors and omissions are noted by the VA team during its review of the design documents, these items are listed so the designer can make the necessary corrections.* ***Do not include this section if there are no comments****.*
- ***Key Drawings*** *– Selected drawings that support the project description and help identify the project scope (if appropriate). Typical drawings are:*
  - *Site Plan*
  - *Alternative Levels of Service*
  - *Intersection Geometrics*
  - *Proposed Layouts*
  - *Typical Cross Sections*
- ***Project Cost Estimate*** *– Include a copy of the original six-page or eleven-page estimate provided with the project documents.*

PROJECT DESCRIPTION

INTRODUCTION

Route 64 begins at the Route 1 Junction and continues easterly through mountainous terrain to the Route 101 Junction. Route 64 runs contiguous with Route 101 for 6.1 km. In South Paseo, Route 64 crosses the Bramble River and continues easterly through agricultural and ranch land. Near the community of Anderson, Routes 14 and 64 join for 10.5 km. East of Chandler, Routes 14 and 64 diverge and continue to the County line.

The proposed improvements will widen State Route 64 from a two-lane conventional highway with intermittent passing lanes to a four-lane expressway, from Airport Road in South Paseo, California, to the intersection with State Route 14, a distance of about 38 kilometers:

- 13-3917UO-NCA-64-KP 51.8/80.8 (Western Section)
- 13-3958OK-NCA-64-KP 80.8/90.0 (Eastern Section)

The project is being designed to use the existing highway as much as possible. Several structures are included. The Western Section is funded through construction, and the Eastern section is funded through the environmental process. The current estimate for the total project, at $235,600,000, significantly exceeds available funding.

PROJECT DESCRIPTION

The purpose of the project is to increase capacity, reduce congestion, enhance safety, and improve Level of Service. The entire corridor is proposed to have 18.6-m median width, and a design speed of 130 km/hr. Where the existing roadway is retained, it will be overlaid with 120 mm of asphalt.

Western Section – Existing Condition

Within the project limits, Route 64 is a two-lane expressway through rolling terrain. The existing highway has 3.6-m lanes and 1.2-m to 3.0-m shoulders. The design speed is a standard 110 km/hr, with horizontal curves varying from 456 m to 3,658 m, and a maximum grade of 6.5%. A truck-climbing lane extends from Solitude Road to the top of the grade for westbound traffic.

Based on the horizontal curves, the minimum design speed is 110 km/hr. However, the vertical alignment has several features that do not meet the current design standard of 110 km/hr:

- Station 8+54, KP 66.9, has an instantaneous grade rate (the grade rate where reversing vertical curves meet) of 4.44%. The standard is 4.0% maximum.

- Station 9+99 to Station 13+03, KP 67.0/67.3, has a crest vertical curve with a stopping sight distance of 85 km/hr.

- Station 15+32 to Station 18+98, KP 67.5/67.9, has a grade of 4.2%.
- Station 19+51 to Station 21+34, KP 68.0/68.1, has a sag vertical curve with a stopping sight distance of 90 km/hr.
- Station 114+04 to Station 117+39, KP 77.5/77.7, has a crest vertical curve with a stopping sight distance of 84 km/hr.
- The existing structure over Chandler Creek has a radius of 610 m and starts at approximately Station 117+69, KP 77.7. Any correction to this vertical curve would also require that the structure be reconstructed. The radius of 610 m meets the current standard of 110 km/hr.

The existing Solitude River Bridge (#49-133) is 88.7 m in length and consists of two 3.6-m lanes and 0.6-m shoulders with a sidewalk. The bridge currently has bridge rails that do not meet current design standards. Initial Bridge Maintenance Reports indicate no reactive aggregate in the existing bridge. Other bridges on Route 64 that were built in the same era as the Solitude River Bridge (1955) were replaced due to reactive aggregate. The STRAIN report identified a potential scour problem.

The existing Chandler Creek Bridge, #49-0095, KP 77.76, is 56.1-m long and consists of two 3.6-m lanes and 2.44-m shoulders. It has a centerline radius of 617 m and starts at Station 117+39. The bridge currently has bridge rails that do not meet current design standards. The March 1997 STRAIN report identified a potential scour problem.

There are vernal pools at the west end of the project limits, a golf course, and a historical building to be considered. A narrower median is being considered to address the issues associated with these areas, but this would also require design exceptions. Thirteen public road intersections and the Anderson Safety Roadside Rest area are within the project limits.

Western Section – Original Concept

The proposed alternative will include 18.6-m median width, 130-km/hr design speed, and reconstruction of the grade to 4%. The eastbound Solitude River Bridge will be widened, and a new westbound Solitude River Bridge is included. One new Chandler Creek Bridge will be constructed to accommodate the two new lanes and shoulders. In addition, the existing bridge will have to be widened to accommodate the new shoulders and to provide a new bridge rail. Three large cross culverts will be extended:

- KP 68.05 – the 3.6-m x 3.0-m reinforced concrete box at Simmons Creek
- KP 69.82 – a 3.6-m x 3.6-m reinforced concrete box
- KP 73.24 – the 3.6-m x 3.0-m reinforced concrete box at McMillan Creek.

Certain areas will require a lower design speed to accommodate horizontal sight distance; design exceptions will be required for using a lower design speed. Significant cuts will be required at the top of the grade, and significant fills will be required to lower the vertical alignment of the Solitude River Bridge. Excavation required for a stageable profile is approximately 3.4 million cubic yards; about 80% of this is between Solitude Road and Union Road, a segment about one mile long. The majority of the widening is to the north of the existing roadway.

The current estimate for the Western Section of the project is $107,418,000.

Eastern Section – Existing Condition

Within the project limits, State Route 64 is a two-lane conventional highway with a westbound passing lane from KP 82.1 to KP 83.7, and an eastbound passing lane from KP 83.3 to KP 85.5. East of Chandler, at KP 88.7, State Routes 64 and 14 diverge and proceed on their independent alignments. The existing cross section consists of 3.6-m wide lanes and shoulder widths that vary from 0 m to 2.4 m. The right-of-way width throughout the project limits varies from 40 m to 60 m.

Horizontal curves throughout the project limits range from 610 m to 4877 m. The design speed, based on the existing horizontal alignment, is the standard 110 km/hr. Listed below are the horizontal and vertical alignment features that do not meet current mandatory design standards:

- A single 488-m horizontal curve exists at KP 83.6. The standard for a design speed of 110 km/hr is 610 m.
- The vertical alignment at KP 85.3 has an instantaneous grade rate (the grade rate where reversing vertical curves meet) of 4.85%. The standard for maximum grade rate for an expressway through rolling terrain is 4%.
- The vertical alignment at KP 85.3 has a crest vertical curve, with a stopping sight distance of 112 m. The standard for a design speed of 110 km/hr is 220 m.

There are two bridges within the project limits. The existing Chandler Creek Bridge (#49-29) at KP 81.5, is 61.6 m long and consists of two 3.6-m lanes and 2.4-m shoulders. The June 1998 STRAIN report identified a potential scour problem. Also located within the project limits is the Chandler Creek Bridge (#49-36) at KP 88.1. This existing bridge is 38.6 m long with two 3.6-m lanes and 2.4-m shoulders. Four public road intersections are located within the project limits.

Factors influencing the proposed project improvements include existing right-of-way widths (more on one side), ease of constructibility, the meandering Chandler Creek, the San Andreas Fault Zone, and the existing facilities adjacent to the right-of-way (oil pumping plant and historical properties).

Eastern Section – Original Concept

The proposed project will include two 3.6-m lanes, a 1.5-m inside shoulder, and a 3.0-m outside shoulder in each direction, an 18.6-m median, and a grade-separated, trumpet-type interchange at the east junction of State Routes 14 and 64. State Route 64 will be realigned with proposed eastbound and westbound lanes north of the existing roadway from KP 80.8 to KP 83.0. The new alignment will be located north of the existing oil refinery oil pumping plant, and it will minimize conflicts with the meandering Chandler Creek. Within this area, existing State Route 64 will remain as a frontage road. For the remainder of the project limits (KP 83.0 to KP 90.0), the proposed State Route 64 proceeds with the eastbound lanes utilizing the existing roadway, and the westbound lanes continuing parallel and to the north of the existing roadway. This alternative will require removing and/or relocating a historical building.

Seven structures are included: eastbound and westbound Chandler Creek Bridge West, eastbound and westbound Chandler Creek Bridge East, two structures at the State Route 14/64 interchange, and replacement of Chandler Creek Bridge #49-29.

The current estimate for the Eastern section of the project is $65,116,400.

INFORMATION PROVIDED TO THE VA TEAM

The following project documents were provided to the VA team for their use during the study:

- Project Study Report, Near South Paseo, Widen to Four Lanes from Airport Road to 1.0 km East of the Roadside Rest Area Caltrans, January, 1998
- Project Study Report (Environmental Only), State Route 64 from 1.0 km East of the Anderson Safety Roadside Rest Area to 1.2 km East of the East Junction of State Routes 14/64, Caltrans, April, 1999
- Preliminary Project Cost Estimates for Both Project Sections, Caltrans, June, 2000
- Aerial Photographs
- Other Technical Data prepared by Caltrans

PROJECT DRAWINGS

Note: While key drawings depicting the project have been omitted in this example, they should be included at the end of the Project Description section.

PROJECT COST ESTIMATE

The six-page project estimate is included on the following pages.

Note: This project was developed with multiple cost estimates. Only one is included for demonstration purposes.

PROJECT PLANNING COST ESTIMATE

Caltrans Metric

District-County-Route	13-NCA-64
Type of Estimate	Project Report
Program Code	HE13
KP	51.8/80.8 - 80.8/90.0
EA	3917U0 / 39580K
PP No.	022CA

PROJECT DESCRIPTION:

Limits: IN NCA COUNTY ON ROUTE 64 NEAR ANDERSON FROM 0.6 KM EAST OF ALMOND-RIVER/GROVE DRIVE TO 1.0 KM EAST OF THE ROADSIDE REST AREA

"Shandon" Section

Proposed Improvement (Scope): CONVERT EXISTING 2-LANE HIGHWAY TO 4-LANE EXPRESSWAY, 3.6-meter LANES, 3-meter OUTSIDE SHOULDERS, AND A 18.6-meter MEDIAN.

Alternate: One

SUMMARY OF PROJECT COST ESTIMATE

TOTAL ROADWAY ITEMS	$	34,485,000
TOTAL STRUCTURE ITEMS	$	5,766,000
SUBTOTAL CONSTRUCTION COSTS	$	40,251,000
TOTAL RIGHT OF WAY ITEMS (*From PSR; cost will increase*)	*$*	*654,000*
TOTAL PROJECT CAPITAL OUTLAY COSTS	**$**	**40,905,000**

Reviewed by District Program Manager _____ (Signature) **Date** June 9, 2000

Phone No. _____

Approved by Project Manager _____ (Signature) **Date** June 9, 2000

Phone No. _____ **Sheet 1 of 6**

ATTACHMENT

Caltrans Metric

District-County-Route n-NCA-64

KP 51.8/80.8 - 80.8/90.0

EA 3917U0 / 39580K

I. ROADWAY ITEMS

Section 1 Earthwork	**Quantity**	**Unit**	**Unit Price**	**Item Cost**	**Section Cost**
Roadway excavation	1,372,700	m^3	$ 5.00	$ 6,863,500	
Imported Borrow				$ -	
Clearing & Grubbing	1	LS	$ 100,000.00	$ 100,000	
Develop Water Supply				$ -	
Shoulder Backing	136	STA	$ 120.00	$ 16,320	
Embankment	460,000	m^3	$ -	$ -	
				Subtotal Earthwork	**$ 6,979,800.00**
Section 2 Pavement Structural Section*					
Asphalt Concrete	125322	tonne	$ 50.00	$ 6,266,100	
Paint Binder	430	tonne	$ 300.00	$ 129,000	
AC Treated Permeable Base	12,256	m^3	$ 60.00	$ 735,360	
Place AC Dike	26984.61	m	$ 2.25	$ 60,715	
PCC Pavement (_____Depth)				$ -	
Cement-Treated Base				$ -	
Lean Concrete Base				$ -	
Aggregate Base, Class 2	34342	m^3	$ 30.00	$ 1,030,260	
Aggregate Subbase, Class 4	97,796	m^3	$ 25.00	$ 2,444,894	
Pavement Reinforcing Fabric				$ -	
Edge Drains	18,863	m	$ 15.00	$ 282,945	
Edge Drain Outlets	3114	m	$ 30.00	$ 93,420	
				Subtotal Pavement Structural Section	**$ 11,042,700.00**
Section 3 Drainage					
Extension of Existing CMP	231	m	$ 300.00	$ 69,300	
Extension of Existing RCP	1,450	m	$ 270.00	$ 391,500	
Remove RC Box Culvert	2	ea	$ 20,000.00	$ 40,000	
Remove Drainage Facility	6	ea	$ 600.00	$ 3,600	
Remove Overside Drain (Includes Slotted Drain)	56	ea	$ 600.00	$ 33,600	
RCB Culverts (3 locations)	1	LS	$ 1,300,000.00	$ 1,300,000	
				Subtotal Drainage	**$ 1,838,000.00**

*Reference sketch showing typical pavement structural section elements of the roadway. Include (if available) T.I., R-Value and date when tests were performed.

Note: Extra Lines are provide for items not listed, use addional lines as appropriate.

Caltrans Metric

District-County-Route n-NCA-64
KP 51.8/80.8 - 80.8/90.0
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I. ROADWAY ITEMS continued

Section 4 Specialty Items	**Quantity**	**Unit**	**Unit Price**	**Item Cost**	**Section Cost**
Retaining Walls				$ -	
Noise Barriers				$ -	
Barriers and Guardrails				$ -	
Equipment / Animal Passes				$ -	
Highway Planting				$ -	
Landscaping and Irrigation				$ -	
Relocate Private Irrigation Facilities				$ -	
Erosion control	51.58	HA	$ 12,000.00	$ 618,960	
Slope Protection	1	LS	$ 250,000.00	$ 250,000	
Water Pollution Control	1	LS	$ 800,000.00	$ 800,000	
Hazadous Waste Mitigation Work				$ -	
Detour	1	LS	$ 625,000.00	$ 625,000	
Environmental Mitigation	1	LS	$ 100,000.00	$ 100,000	
Resident Engineer Office Space	1	LS	$ 50,000.00	$ 50,000	
Temporary Barrier, K-Rail	1900	m	$ 35.00	$ 66,500	
Fence (Type BW-5 Strand)	19,055	m	$ 7.00	$ 133,385	
				Subtotal Specialiy Items	**$ 2,643,800**
Section 5 Traffic Items					
Electrical	1	LS		$ -	
Traffic Delineation Items	1	LS	$ 118,500.00	$ 118,500	
Traffic Signals				$ -	
Overhead Sign Structures		m		$ -	
Road Side Signs				$ -	
Transportation Management Plan	1	LS	$ 750,000.00	$ 750,000	
Traffic Control Systems	1	LS	$ 100,000.00	$ 100,000	
COZEEP	1	LS	$ 500,000.00	$ 500,000	
Misc. Detour Striping	1	LS	$ 50,000.00	$ 50,000	
Temporay Crash Cushion	1	LS	$ 55,000.00	$ 55,000	
Weigh In Motion Station	1	LS	$ 250,000.00	$ 250,000	
				Subtotal Traffic Items	**$ 1,823,500**
				TOTAL SECTIONS 1 thru 5	**$ 24,327,800**

Note: Extra Lines are provide for items not listed, use addional lines as appropriate.

Caltrans Metric

District-County-Route n-NCA-64
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EA 3917U0 / 39580K

Section 6 Minor Items		**Item Cost**	**Section Cost**
$24,327,800 (Subtotal Sections 1 thru 5)	x 5.0% (5 to 10%) =	$ 1,216,390	
	TOTAL MINOR ITEMS		**$ 1,216,400**

Section 7 Roadway Mobilization

$25,544,200 (Subtotal Sections 1 thru 6) x 10% = $ 2,554,420

TOTAL ROADWAY MOBILIZATION **$ 2,554,400**

Section 8 Roadway Additions

Supplemental Work

$25,544,200 (Subtotal Sections 1 thru 6) x 5% (5 to 10%) = $ 1,277,210

Contingencies

$25,544,200 (Subtotal Sections 1 thru 6) x 20% (** PDPM 3-50.20) = $ 5,108,840

TOTAL ROADWAY ADDITIONS **$ 6,386,100**

TOTAL ROADWAY ITEMS **$ 34,484,700**

(Subtotal Sections 1 thru 8)

Estimate Prepared By Ron Seinfeld (Print Name) Phone No. (805) 555-3649 Date. June 9, 2000

Estimate Prepared By _____ (Print Name) Phone No. _____ Date. _____

** Use appropriate percentage per Project Development Procedures Manual 3-50.20
Project Feasibility - 30% - 50%
PSR ---------- 25%
Draft PR ---------- 20%
PR ---------- 15%

Caltrans Metric

District-County-Route n-NCA-64

KP 51.8/80.8 - 80.8/90.0

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II. STRUCTURE ITEMS

	Structure (1)	**Structure (2)**	**Sturcture (3)**		**Section Cost**
Bridge Name	Chandler Cr. Br.	McMillan Cy. Br.	Shimmin Br. (Prvt.)		
Structure Type		(Box Culvert)	Removal (PM 42.29)		
Width (out to out) - (m)					
Span Lengths - (m)					
Total Area - (sq. m)	0	0	0		
Footing Type (pile/spread)					
Cost Per square meter (incl. 10% mobilization and 20% contingency)					
Total cost for Stucture	$4,419,000	$1,149,000		=	**$5,568,000**
Structure Removal	$120,000	$50,000	$28,000	=	**$198,000**

TOTAL STRUCTURES ITEMS **$5,766,000**

COMMENTS: _____

Estimate Prepared By _____ Phone No. _____

(Print Name)

Date _____

Note: If Appropriate, attach additional pages and backup.

Caltrans Metric

District-County-Route n-NCA-64

KP 51.8/80.8 - 80.8/90.0

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III. RIGHT OF WAY ITEMS — Excalated Value

A. Acquisition, including excess lands, damages to remainder(s) and Goodwill _____

B. Utility Relocation (State share) _____

C. Relocation Assistance _____

D. Clearance / Demolition _____

E. Title and Escrow Fees _____

TOTAL RIGHT OF WAY ITEMS (Escalated Value) $ 654,329

Anticipated Date of Right of Way Certificaiton (Date to which Values are Escalated) _____

F. Construction Contract Work

Brief Description of Work:

_____

_____

_____

_____

Right of Way Branch cost Estimate of Work * _____

* This dollar amount is to be included in the Roadway and/or Structures Items of Work, as appropriate. Do not include Right of Way Items.

COMMENTS:

"THIS IS FROM THE PSR ESTIMATE AND WILL BE UPDATED. THE COSTS WILL INCREASE".

Estimate Prepared BY _____ Phone No. _____

(Print Name) Date _____

Caltrans Metric

District-County-Route n-NCA-64
KP 51.8/80.8 - 80.8/90.0
EA 3917U0 / 39580K
Date June 9, 2000

1998 Contract Cost Data

Cost Estimate Section	Item Code Number	Description	Cost	Unit
Section 1, Earthwork	190101	Roadway excavation	$ -	m^3
	150769	Remove Asphalt Concrete	$ -	LS
	160101	Clearing and Grubbing	$ -	LS
Section 2, Str. Section	390103	Asphalt Concrete	$ -	tonn
	260201	Aggregate Base, Class II	$ -	m^3
	393001	Pavement Reinforcing Fabric	$ -	m^2
	394046	Place AC Dike Type "E"	$ -	m
Section 3, Drainage	150801	Remove Overside Drain (Includes Slotted Drain)	$ -	
	150804	Remove Drainage Facility	$ -	
	150825	Remove Reinforced Box Culvert	$ -	
	510129	RCB Culverts		
	664008	200 mm CSP (2.01 thick)		
	664020	600 mm CSP (2.01 thick)		
	664044	1200 mm		
	650018	24" RCP (0.61M)		M
	650024	30" RCP (0.740M)		M
	650034	48" RCP (1.22M)		M
Section 4, Specialty Items	203015	Erosion Control	$ -	m^3
	129000	Temporary Barrier, Type K	$ -	m
Section 5, Traffic Items	840515	Thermoplastic Pavement Markings (Words)		
	840656	Traffic Delineation Items - Painted Stripe		
	840560	Thermoplastic Traffic Stripe (Sprayable)		
	840561	Traffic Delineation Items - 100 mm Thermoplastic		
	850101	Traffic Delineation Items - Traffic Markers		
	850102	Traffic Delineation Items - Traffic Markers		
	120100	Traffic Control Systems - per day	$ -	EA
	128601	Temporary Signal	$ -	EA
	129100	Temporary Crash Cushion	$ -	EA

Idea Evaluation

IDEA EVALUATION

The Idea Evaluation section of the report discusses the procedures used to develop and evaluate the creative ideas, and to document the evaluated and ranked ideas. It is a detailed methodology that forms the basis for an objective, criteria-based evaluation of ideas so that a broad set of key criteria are applied to the ideas rather than a narrow set of only one or two criteria.

Report Text. The Idea Evaluation text provides a summary of the process used to evaluate the creative ideas generated by the VA team.

Idea Evaluation. *The example Idea Evaluation section covers three topics:*

- ***Performance Criteria*** *– Describes the key evaluative criteria*
- ***Evaluation Process*** *– Describes the process used by the VA team to evaluate the ideas*
- ***Idea Evaluation Forms*** *– The use of this form is described in the Team Guide.*

IDEA EVALUATION

INTRODUCTION

The ideas generated by the VA team are carefully evaluated, and project-specific criteria are applied to each idea to assure an objective evaluation.

PERFORMANCE CRITERIA

The VA team used the paired comparison method to prioritize the key performance criteria for this project:

- Mainline Traffic Operations
- Highway User Safety
- Access
- Local Traffic Operations
- Constructibility
- Environmental Impacts
- Right-of-Way Impact

The team enlisted the assistance of the stakeholders and designers (when available) to develop these criteria so that the evaluation would reflect their specific requirements. Refer to the Project Analysis – Performance Criteria Matrix section of the report for further details.

EVALUATION PROCESS

The VA team, as a group, generated and evaluated ideas on how to perform the various functions. The idea list was grouped by function or major project element. While ideas on the overall project were evaluated as a group, ideas relating to a specific technical discipline may have been evaluated by the team member representing that discipline.

The team compared each of the ideas with the original concept for each of the performance criteria to determine whether it was better than, equal to, or worse than the original concept. The team reached a consensus on the ranking of the idea. High-ranked ideas would be developed further; low-ranked ones would be dropped from further consideration.

IDEA EVALUATION FORMS

All of the ideas that were generated during the creative phase using brainstorming techniques were recorded on the following Idea Evaluation forms. These ideas were discussed and the advantages and disadvantages of each were listed.

IDEA EVALUATION FORMS

The Idea Evaluation worksheets are used to record the discussions of the VA team during the Evaluation Phase. The documented information shows how the team reached a consensus about the suitability of an alternative idea and ranked all ideas for further development.

> ***Idea Evaluation.*** *The example Idea Evaluation records the results of the evaluation discussion. The criteria are coded (M, S, A, etc.) to facilitate discussion and recording of ratings. The key for the codes is included in the page footer.*

Refer to the VA Team Guide for additional information on how Idea Evaluation forms are completed.

IDEA EVALUATION *Example Project*										Caltrans		
Ideas		**Performance Criteria**							**Advantages**	**Disadvantages**	**$**	**Rank**
No.	**Function**	**M**	**S**	**A**	**L**	**C**	**E**	**RW**				
	INCREASE CAPACITY											
IC-1	Relocate/consolidate/improve at-grade intersections	0	+2	0	+2	0	0	0	◆ Could reduce environmental impact ◆ Reduces vehicle conflicts	◆ Could negatively impact previously avoided environmentally sensitive areas	0	4
IC-2	Have variable median appropriate for topography and location	0	-1	0	0	+1	+2	+2	◆ Reduces earthwork in large cut areas ◆ Avoids environmentally sensitive areas ◆ Reduces footprint ◆ Reduces right-of-way requirements	◆ Reduces recovery area ◆ Challenges design criteria ◆ Reduces opportunity for future widening	+2	5
IC-3	Undercrossing at Olive Hill Road with interchange	+2	+2	+2	+2	-1	-1	-1	◆ Improves traffic operations ◆ Good sight distance ◆ Improves pedestrian and cyclist safety crossing State Route ◆ Eliminates at-grade intersection ◆ Reduces number of traffic lights ◆ Improves transition to new County bridge	◆ Increases construction cost ◆ Requires additional right-of-way ◆ Hook ramps are generally undesirable ◆ Freeway-type interchange may not match rural area ◆ Hinders bicycle movements on State Route	-1	4

Ranking Scale: **5 = Significant Value Improvement** **4 = Good Value Improvement** **3 =Minor Value Improvement**
2 = Minor Value Degradation **1 = Significant Value Degradation or Does Not Meet Project Purpose and Need**

Evaluation Criteria Rating: **Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**

M = Mainline Traffic Operations **S = Highway User Safety** **A = Access** **L = Local Traffic Operations**
C = Constructibility **E = Environmental Impacts** **RW = Right-of-Way Impacts**

Value Analysis Process

VALUE ANALYSIS PROCESS

This report section gives an overview of the pre-study preparation, study performed, and post-study implementation activities, and includes the agenda and daily attendance sheets. It is a record of the persons participating on the VA team, as well as those who assisted during the study. It includes a detailed summary of the VA methodology followed during the study.

Value Analysis Process. *The example Value Analysis Process section summarizes the value methodology:*

- ***Introduction*** *– Introduces the VA procedures used in the study*
- ***Preparation*** *– States the activities done before the formal study began*
- ***VA Study*** *– Summarizes the ten activities within the team study*
- ***Report*** *– Outlines the two activities following the study*

VA Study Agenda. *The example agenda used in the VA Study is a six-day VA Study and a two-day Segment 3. The specific agenda is tailored to the VA Study as needed.*

Daily Attendance Sheets. *The example daily attendance sheets record the attendance of each person involved in each day of a study.*

VALUE ANALYSIS PROCESS

INTRODUCTION

The Value Analysis process involves fifteen activities needed to accomplish a VA Study, organized in three parts: Preparation, VA Study, and Report. The following Caltrans VA Study Activity Chart describes each activity; the individual tasks are summarized below.

PREPARATION

Prior to the start of a VA Study, the District VA Coordinator (DVAC) and Team Leader carry out the following three activities:

- **Initiate Study** – Identify study project; define study goals; prepare draft study charter and Task Order Initiation Document.
- **Organize Study** – Conduct preparation meeting; select team members; finalize study charter and Task Order Initiation Document
- **Prepare Data** – Collect and distribute data; prepare cost models; develop LCC model.

All of the information gathered prior to the VA Study is given to the team members for their use.

VA STUDY

There are ten activities carried out by the VA team during the performance of the study, organized in three segments:

Segment 1

- **Inform Team** – Receive designer presentation; develop performance criteria; visit project site.
- **Analyze Functions** – Identify basic functions and cost drivers; prepare FAST diagram.
- **Create Ideas** – List a large quantity of alternative ideas; use group/individual brainstorming.
- **Evaluate Ideas** – Evaluate all ideas against performance criteria; rank all ideas.

Segment 2

- **Develop Alternatives** – Develop high-ranked ideas into VA alternatives; measure performance.
- **Critique Alternatives –** Team and Technical Reviewer review of alternatives to develop and ensure team consensus and technical viability. Develop and rate recommended VA alternatives.
- **Present Alternatives** – Give interim presentation of alternatives; prepare preliminary report.

Segment 3

- **Assess Alternatives** – Review alternatives; prepare draft implementation decisions.
- **Resolve Alternatives** – Resolve dispositions; edit and revise alternatives; summarize results.
- **Present Results** – Give final presentation of accepted alternatives.

REPORT

Following the VA Study, the Team Leader assembles all study documentation into the final report:

- **Publish Results** – Prepare Final VA Study Report; distribute printed and electronic copies.
- **Close-Out VA Study** – Resolve open conditionally accepted VA alternatives and update the Executive Summary and VASSR. Provide final deliverables to the HQ VA Branch.

The VA Study is complete when the report is issued as a record of the VA team's analysis and development work, as well as the project development team's implementation dispositions for the alternatives.

Performance measures are integral to the VA process and are used throughout the VA Study. The following detailed discussion of the performance measures provides better clarification of how they are used within the VA process. A VA Study Activity Chart, which outlines the fifteen VA activities in more detail, follows the performance measures. The VA Study Agenda and Meeting Attendees sheet, which document the schedule and participants in the VA Study, are at the end of this section.

CALTRANS PROJECT PERFORMANCE MEASUREMENT

INTRODUCTION

The methodology described herein measures project value by correlating the performance of project scope and delivery to the project costs. The objective of this methodology is to prescribe a systematic, objective approach to study and optimize a project budget, schedule, and scope. This serves the transportation community by identifying a quantifiable methodology to effectively analyze and compare the three project management components (scope, schedule, and budget), and measure resulting project value.

Project performance measures are an integral part of the Caltrans Value Analysis (VA) methodology and consist of a set of techniques as follows:

- Identify key project (scope and delivery) performance criteria for the project
- Establish the hierarchy and impact of these criteria upon the project
- Establish the baseline of the current project performance by evaluating and rating the effectiveness of the current design concepts
- Identify the change in performance of alternative project concepts generated by the study
- Measure the aggregate effect of alternative concepts relative to the baseline project's performance as a measure of overall value improvement

It is important that the project performance criteria be well defined and agreed to by the stakeholders at the start of the study, as they are used throughout the study to identify, evaluate, and document alternatives. Project scope performance improvements are also one of the critical quantifiable results of a Caltrans study. All subsequent references to "project scope and delivery performance" will be abbreviated to "performance".

The primary goal of value analysis is to improve project value. A simple way to think of value in terms of an equation is as follows:

$$\textit{Value} = \frac{\textit{Project Performance (Scope \& Delivery)}}{\textit{Project Cost}}$$

Value analysis has traditionally been perceived as an effective means for reducing project costs. This paradigm only addresses one part of the value equation, oftentimes at the expense of overlooking the role that VA can play with regard to improving project performance. Project costs are fairly easy to quantify and compare through traditional estimating techniques. Performance is not so easily quantifiable.

The Caltrans VA Program has developed a unique methodology using a variety of techniques aimed at identifying, defining, and quantifying performance. Once this has been accomplished, the interrelationship between cost and performance can be quantified and compared in terms of how they contribute to overall value.

The direct and active involvement of the project's stakeholders is at the core of this process. The VA Team Leader will lead Caltrans and external stakeholders through the methodology, using the power of the process to distill subjective thought into an objective language that everyone can relate to and understand. The dialog that develops forms the basis for the VA team's understanding of the performance requirements of the project and to what degree the current design concept is meeting those requirements. From this baseline, the VA team can focus on developing alternative concepts that will quantify both performance and cost and contribute to overall project value.

The Caltrans approach to project performance yields the following benefits:

- Builds consensus among project stakeholders (especially those holding conflicting views)
- Develops a better understanding of a project's goals and objectives
- Develops a baseline understanding of how the project is meeting performance goals and objectives
- Identifies areas where project performance can be improved through the VA process
- Develops a better understanding of a VA alternative's effect on project performance
- Develops an understanding of the relationship between performance and cost in determining value
- Uses value as the true measurement for the basis of selecting the right project or design concept
- Provides decision makers with a means of comparing costs and performance (i.e., costs vs. benefits) in a way that can assist them in making better decisions.

METHODOLOGY

The application of performance methodology consists of the following steps:

1. Define the major performance criteria
2. Determine the relative importance of the criteria
3. Establish the performance "baseline" for the original design
4. Evaluate the performance of the VA alternative concepts
5. Compare the performance ratings of alternative concepts to the "baseline" project

Assumptions

Before embarking on the details of this methodology some assumptions need to be identified:

- An evaluation of the creative ideas (ideas generated during the brainstorming, creative sessions—not to be confused with VA alternative concepts described in Step 4) is done between Steps 3 and 4. The idea evaluation process remains true to the "value" approach of measuring performance and costs; however, due to the time constraints, the idea evaluation is a qualitative form of evaluating ideas, as opposed to the quantitative procedures done in the other steps.

- The methodology described in the following steps assumes the project functions are well established. Project functions are "the what" the project delivers to its users and stakeholders; a good reference for the project functions can be found in the environmental document's purpose and need statement. Caltrans' project functions are generally well defined prior to the start of the VA Study. In the event that project functions have been substantially modified, the methodology must begin anew from the beginning (Step 1).

Step 1 – Determine the Major Performance Criteria

Performance criteria can generally be divided between Project Scope components (Highway Operations, Environmental Impacts, and System Preservation) and Project Delivery components.

The VA Team Leader will initially request that representatives from Caltrans and external stakeholders identify performance criteria that they feel are essential to meeting the overall need and purpose of the project. Usually four to eight criteria are selected. It is important that all potential criteria be thoroughly discussed. The information that comes out of this discussion will be valuable to both the VA team and Caltrans. It is important that the criteria be discretely defined, and they must be quantifiable in some form. By quantifiable, it is meant that a useable scale must be delineated with values given on a scale of 1 to 10. A "1" indicates poor value, while a "10" indicates excellent value. The vast majority of performance criteria that typically appear in Caltrans VA studies have been standardized. This standardized list can be used "as is" or adopted with minor adjustments as required. Every effort should be made to make the ratings as objective as possible.

Step 2 – Determine the Relative Importance of the Criteria

Once the group has agreed upon the project's performance criteria, the next step is to determine their relative importance in relation to each other. This is accomplished through the use of an evaluative tool termed in this paper as the "Performance Criteria Matrix." This matrix compares the performance criteria in pairs, asking the question: "Which one is more important to the project?" A letter code (e.g., "a") is entered into the matrix for each pair, identifying which of the two is more important. If a pair of criteria is considered to be of essentially equal importance, both letters (e.g., "a/b") are entered into the appropriate box. This, however, should be discouraged, as it has been found that in practice a tie usually indicates that the pairs have not been adequately discussed. When all pairs have been discussed, the number of "votes" for each is tallied and percentages (which will be used as weighted multipliers later in the process) are calculated. It is not uncommon for one criterion to not receive any "votes." If this occurs, the criterion is given a token "vote", as it made the list in the first place and should be given some degree of importance.

It is important for the VA Team Leader to remind the group that, as they evaluate each pair of criteria, they should think of performance trade-offs in hypothetical terms as they relate to the project's overall need and purpose. For instance, the VA Team Leader might state, "If we were considering a concept that would improve mainline traffic operations, but at the expense of reducing access between the freeway and local streets, which criterion would be more critical in meeting the project's intended need and purpose?" The team should also be reminded that these performance criteria will be used to evaluate the merits of alternative concepts generated during the course of the VA Study. As such, the group should keep an open mind and base their evaluation on what is possible rather than what exists in terms of the current design concept.

Step 3 – Establish the Performance "Baseline" for the Original Design

The next step in the process is to evaluate how well the original design is addressing the project's performance criteria. This step establishes a "baseline" to which the VA alternative concepts can be compared against. The Performance Rating Matrix is used to assist the VA team in determining the performance ratings for the original design concept. Representatives from the Caltrans design team and external stakeholders next begin assigning a 1 to 10 rating for each criterion, using the definitions and scales developed in Step 1.

Once the 1 to 10 ratings for the various criteria have been established, their total performance should be calculated by multiplying the criteria's weight (which was developed in Step 2) by its rating. Once the total performance for each criterion has been determined, the original design's total performance can be calculated by adding all of the scores for the criteria. The concept's total performance will be somewhere between 100 and 1,000 points. A concept scoring 1,000 would represent a hypothetically "perfect" design concept, with all performance criteria being addressed to their theoretical maximum. This numerical expression of the original design's performance forms the "baseline" against which all alternative concepts will be compared.

Step 4 – Evaluate the Performance of the VA Alternative Concepts

Once the performance baseline has been established for the original design concept, it can be used to help the VA team develop performance ratings for individual VA alternative concepts as they are developed during the course of the VA Study. The Performance Measures form is used to capture this information. This form allows a side-by-side comparison of the original design and VA alternative concepts to be performed.

It is important to consider the alternative concept's impact on the entire project, rather than on discrete components, when developing performance ratings for the alternative concept

Step 5 – Compare the Performance Ratings of Alternative Concepts to the "Baseline" Project

The last step in the process completes the Performance Rating Matrix that was initially begun to develop the performance ratings for the original design concept. The VA team groups the VA alternatives into a set (or sets) to provide the decision makers a clear picture of how the alternatives fit together into possible solutions. At least one set is developed to present the VA team's consensus of what should be implemented. Additional sets are developed as necessary to present other combinations to the decision makers that should be considered. The set(s) of VA alternatives are rated and compared against the original concept. The performance ratings developed for the VA alternative sets are entered into the matrix, and the summary portion of the Performance Rating Matrix is completed. The summary provides details on net changes to cost, performance, and value, using the following calculations.

- % Performance Improvement = ΔPerformance VA Alt. Set / Total Performance Original Concept
- Value Index = Total Performance / Total Cost (in Millions)
- % Value Improvement = ΔValue Index VA Alt. Set / Value Index Original Concept

The stakeholders are asked to validate the performance measures and rationale at the Implementation Meeting. The rationale for the numerical rating change for each alternative in each set is developed. The Performance Rating Matrix shows the numerical change for each performance measure and alternative set. The Total Performance is calculated by multiplying the criteria weight by the performance rating for each performance measure of either the original concept or VA set.

CONCLUSION

The development and integration of performance measurements into the value methodology employed on Caltrans studies has improved the effectiveness of the Value Analysis Program as applied to highway projects by providing a reliable, integrated method of measuring performance and, consequently, value. This in turn has allowed the program to more easily discuss implementation the disposition of the alternatives, justify alternatives with cost increases, apply value analysis more effectively to projects in the earlier stages of project development, and to better capture input from participating project stakeholders.

The application of performance measurements within a VA Study neither supplants nor reduces the authority of the Project Development Team (notably Design and Environmental Units) from developing, analyzing, and refining the project scope issue contained in the above two major categories. The intent of the project (scope) performance measurements, within the context of a VA Study, is for the VA team to address the relevant project scope issues. These may help the Project Development Team, but they do not supplant their role as the final decision makers on the project scope.

Caltrans Value Analysis Activity Chart

PREPARATION

INITIATE STUDY — 1
- Identify study project
- Identify study roles and responsibilities
- Define study goals
- Select team leader
- Prepare draft Study Charter

ORGANIZE STUDY — 2
- Conduct Pre-Study Meeting
- Select team members
- Identify stakeholders, decision-makers, and technical reviewers
- Identify data collection
- Select study dates
- Determine study logistics
- Update VA Study Charter

PREPARE DATA — 3
- Collect and distribute data
- Develop construction cost models
- Develop highway user benefit / life cycle cost (LCC) model

VA STUDY

Segment 1

INFORM TEAM — 4
- Review study activities and confirm reviewers
- Present design concept
- Present stakeholders' interests
- Review project issues and objectives
- Identify key functions and performance criteria
- Visit project site

ANALYZE FUNCTIONS — 5
- Analyze project data
- Expand project functions
- Prepare FAST diagram
- Determine functional cost drivers

CREATE IDEAS — 6
- Focus on functions
- List all ideas
- Apply creativity and innovation techniques (group and individual)

EVALUATE IDEAS — 7
- Apply key performance criteria
- Consider cost impacts
- List advantages and disadvantages
- Rate each idea
- Rank all ideas
- Assign alternatives for development

Segment 2

DEVELOP ALTERNATIVES — 8
- Develop alternative concepts
- Prepare sketches and calculations
- Measure performance
- Estimate costs, LCC benefits/costs

CRITIQUE ALTERNATIVES — 9
- VA Alternatives Technical Review
- VA Alternatives Team Consensus Review
- Identify mutually exclusive groups of alternatives
- Identify VA sets
- Validate performance

PRESENT ALTERNATIVES* — 10
- Present findings
- Document feedback
- Confirm pending reviews
- Prepare preliminary report

**Interim presentation of study findings*

Segment 3

ASSESS ALTERNATIVES** — 11
- Review Preliminary Report
- Assess alternatives for project acceptance
- Prepare draft implementation dispositions

***Activities performed by PDT, Technical Reviewers, and Stakeholders*

RESOLVE ALTERNATIVES — 12
- Review implementation dispositions
- Resolve implementation actions with decision-makers and stakeholders
- Edit alternatives
- Revisit rejected alternatives, if needed

PRESENT RESULTS* — 13
- Present results
- Obtain management approval on implemented alternatives
- Summarize performance, cost, and value improvements

**Final presentation of study results*

REPORT

PUBLISH RESULTS — 14
- Document process and study results
- Incorporate all comments and implementation actions
- Distribute Final VA Report
- Distribute electronic report to HQ VA Branch
- Update VA Study Summary Report (VASSR)
- Provide HQ the Final VA Report in pdf format

CLOSE OUT VA STUDY — 15
(if Conditionally Accepted Alternatives exist)
- Resolve Conditionally Accepted Alternatives
- Finalize VA Study Summary Report (VASSR)
- Finalize Performance Measures
- Finalize VA Report Executive Summary and provide electronically to HQ

Note: The dashed boxes indicate steps that ***may*** not be required in some VA Studies.

District 13 – Project Name

VA STUDY AGENDA

Tuesday, June 13

8:30 - 8:45	Introductions (All)
8:45 - 9:00	Brief Overview of the VA Process (VA Facilitator)
9:00 - 9:15	Remarks by Executive Director, Local COG
9:15 - 10:30	Project Overview (Project Engineers)
10:30 - 10:45	Break
10:45 - 12:30	Function Identification, Performance Criteria Development, Ranking of Baseline
12:30 - 1:30	Lunch
1:30 - 4:30	Site Visit

Wednesday, June 14

8:00 – 9:00	Recap of First Day/Review of New Information
9:00 - 10:00	Identify Observations Made on Site Visit
10:00 – 11:30	VA Objectives / Focus / Opportunities
11:30 – 12:30	Lunch
12:30 – 2:00	Function Analysis / Fast Diagram
2:00 – 3:00	Team Brainstorming
3:00 – 3:15	Break
3:15 – 5:00	Team Brainstorming

Thursday, June 15

8:00 – 10:00	Team Brainstorming
10:00 – 10:15	Break
10:15 – 12:00	Evaluation of Ideas
12:00 – 1:00	Lunch
1:00 – 4:00	Evaluation of Ideas, Assignment of VA Alternatives

Tuesday, June 20

8:00 – 9:00	Distribution/Review of Handouts from Segment 1 and VA Alternative Forms
9:00 – 12:00	Alternative Development
12:00 – 1:00	Lunch
1:00 – 5:00	Alternative Development

Wednesday, June 21

8:00 – 12:00	Alternative Development
12:00 – 1:00	Lunch
1:00 – 3:00	Meet with Technical Reviewers
3:00 – 5:00	Alternative Development

Thursday, June 22

8:00 – 12:00 Alternative Development
12:00 – 1:00 Lunch
1:00 – 4:00 Team Review of Alternatives; Grouping and Performance Ranking of Alternatives

Tuesday, August 8

8:00 – 12:00 Review of Comments on Preliminary Report; Revision of Alternatives
12:00 – 1:00 Lunch
1:00 – 4:00 Disposition Meeting with Decision Makers

Wednesday, August 9

9:00 – 11:00 Final Performance Ranking of Implemented VA Alternatives
11:00 – 12:00 Presentation Preparation
12:00 – 1:00 Lunch
1:30 – 3:30 Presentation of VA Study Results to Caltrans Management and External Stakeholders

MEETING ATTENDEES

This report section is a record of the persons who were on the VA team, assisted during the study, and attended presentation and implementation meetings. The list also includes their organizations, positions during the study, telephone and fax numbers, and e-mail addresses.

> ***Daily Attendance Sheets.*** *The example daily attendance sheets record the attendance of each person involved in each day of a study.*

MEETING ATTENDEES *Example Project*										Caltrans		
2000								NAME	ORGANIZATION	POSITION	TELEPHONE	FAX
June						August					E–MAIL	
13	14	15	20	21	22	8	9					
X	X	X	X	X	X	X	X	Ginger Adams, CVS	Value Management Strategies, Inc.	VA Team Leader	760 555-3012	555-5571
											Ginger@vms-inc.com	
X	X	X	X	X	X	X	X	Mark Creveling	Simon Wong Engineering	Bridge Engineer	858 555-3113	555-6844
											mark@simonwongeng.com	
X	X	X	X	X	X	X	X	Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	760 555-3495	555-3490
											frasereng@aol.com	
X	X	X	X	X	X	X	X	Meg Williams	City of South Paseo	Principal Planner	805 555-3970	555-6565
											meg@prcity.com	
X	X	X	X	X	X	X		Steve Dennison	Regional Transportation Agency	Planning Program Manager	805 555-4662	555-5703
											sdennison@slocog.org	
X	X	X	X	X	X	X	X	Terry Hodges	Caltrans	Traffic Operations	805 555-3664	555-3045
											Terry_Hodges@dot.ca.gov	
X		X	X	X	X	X	X	Jeff West	Caltrans	Design	805 555-3393	555-3480
											Jeff_West@dot.ca.gov	
X	X		X	X	X	X	X	Mary E. Campbell	Local Transportation Committee	Chairperson	805 555-2888	
											mec@thegrid.net	

Close Out VA Study

CLOSE OUT STUDY – DELIVERABLES

If there are unresolved conditionally accepted (CA) alternatives at the time of publishing the Final Report, the VA Team Leader is responsible for working with the Project Manager and District VA Coordinator to identify activities necessary to resolve each conditionally accepted alternative and identify the probable timetable for resolution. This provides the necessary information for the VA Team Leader to efficiently and effectively follow-up on these alternatives and ensures that timely disposition is achieved.

Once the disposition of all conditionally accepted alternatives is resolved, the Team Leader will document these decisions by submitting electronic copies of the updated complete VA Study Summary Report and updated Executive Summary to the PM, DVAC, and the HQ VA Branch.

Sections of these documents that require editing include:

Cover Letter

- ☐ ***Cover Letter*:** A formal transmittal of the Study Close-Out Documents.

Executive Summary

- ☐ ***Synopsis*:** Edit to reflect final disposition and resolution of the conditionally accepted alternatives. Note: Be sure to remove references to conditionally accepted alternatives that were included in the Final Report.
- ☐ ***VA Study Results*:** Edit to reflect final disposition and resolution of the conditionally accepted alternatives. Note: Be sure to remove references to conditionally accepted alternatives that were included in the Final Report.
- ☐ ***Rating Rationale—Accepted Alternatives*:** Revise the rationale as needed, based on final disposition of the conditionally accepted alternatives.
- ☐ ***Performance Rating Matrix—Accepted Alternatives*:** Revise the ratings as needed, based on final disposition of the conditionally accepted alternatives, and recalculate the performance and value measures.

VA Study Summary Report

- ☐ ***VA Study Summary Report—Task Order Identification:*** No changes anticipated.
- ☐ ***VA Study Summary Report—Participants and Schedule*:** No changes anticipated.
- ☐ ***VA Study Summary Report—Proposed Alternatives:*** No changes anticipated.
- ☐ ***VA Study Summary Report—Accepted Alternatives:*** Revise to reflect final disposition of conditionally accepted alternatives.
- ☐ ***VA Study Summary Report—Conditionally Accepted Alternatives (Page 1):*** Delete.
- ☐ ***VA Study Summary Report—Conditionally Accepted Alternatives (Page 2):*** Delete.
- ☐ ***VA Study Summary Report—Benefits:*** Revise to reflect final disposition of the conditionally accepted alternatives. All information on this page is subject to change, based on the final disposition of the conditionally accepted alternatives. Consider the added cost of the study (for follow-up activities); determine changes in savings, performance, and value; edit the benefits of the study; and revise project delivery schedule impacts.

Edits for the Study Close-Out of this example project are noted with a dashed box around edited text and double ~~strike through~~ lines on deleted text.

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: **PM**
District DVAC
HQ VA Branch

Date: July 22, 2001
File: 303

From: **VA Team Leader**

Since the Implementation Meeting on _____, we have been able to resolve the disposition of the conditionally accepted VA alternatives. Attached are revisions to the Final Executive Summary and Final Value Analysis Study Summary Report for the referenced project, which detail the disposition of the conditionally accepted alternatives and finalize the VA Study reporting requirements.

These electronic copies are intended for the Project Manager, DVAC, and HQ VA Branch. Additional distribution of this information is at the discretion of the Project Manager.

This concludes the VA Study activities for this project.

If you have any questions or comments concerning the final report, please contact me at _____.

Sincerely,

SYNOPSIS

CLOSE OUT VA STUDY

The proposed project consists of widening State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers.

This project is divided into two segments: one is in the PA&ED Phase, and one is in the PID Phase. The total cost of these segments is approximately $235,600,000. The VA team identified several VA alternatives that consider modified intersections, median width, roadway alignment, drainage, and the SR 14/SR 64 Interchange. The most significant VA alternatives recommended reducing the design speed in certain areas of the project.

The accepted VA alternatives reduced the project's excavation quantities by over 70%, reduced almost a mile of existing sustained 6% grade to 4%, eliminated an existing intersection at the bottom of a sustained grade, significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on/across the highway, and reduced construction time by at least one year. The use of the interchange in lieu of the intersection eliminates the only traffic signal within the project limits. It also reduces turning conflicts and should help to further reduce the accident rate in the area. The five accepted VA alternatives result in cost savings of $29,800,000, performance improvement of 19%, and value improvement of 43%. One of the accepted VA alternatives increases initial cost $2,300,000 but reduces highway user costs by approximately $29,700,000.

~~One additional VA alternative was conditionally accepted, which will further reduce excavation and right-of-way impact. Acceptance of this alternative would result in additional savings of $6,000,000 with minimal performance improvement.~~

EXECUTIVE SUMMARY

CLOSE OUT VA STUDY

INTRODUCTION

This Value Analysis (VA) Report summarizes the events of the VA Study conducted by Caltrans District 13 and facilitated by Value Management Strategies, Inc. The subject of the study was the SR 64 Road Widening in NCA County, California:

- 13-3917U0-NCA-64-KP 51.8/80.8 (Western Section)
- 13-39580K-NCA-64-KP 80.8/90.0 (Eastern Section)

The VA Study was intended to focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders.

PROJECT DESCRIPTION

The proposed project will widen State Route 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of State Route 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. The western section is funded through construction, and the eastern section is funded through the environmental process. The current estimate of $235,600,000 for the total project significantly exceeds available funding.

PROJECT ISSUES

The following are some of the issues and concerns associated with the widening project:

- Approximately 80% of excavation in the western section is in a one-mile segment at the Solitude Grade.
- Chandler Creek crosses the roadway several times in the western section.
- A roadside rest in the western section will require overcrossings or an interchange, unless another rest area is constructed on the opposite side of the highway.
- The eastern section must deal with significant utility relocations, including oil pipelines.
- The interchange at SR 14/SR 64 must avoid wetlands to the south and east, and the San Andreas Fault to the west.
- Design exceptions will be required in select areas to be able to use a design speed lower than 130 km/h.
- Environmental impacts include vernal pools, wetlands, wildlife habitats, potential for hazardous waste, and some historic considerations.

PROJECT ANALYSIS

The VA team analyzed the project using the Value Analysis tools and job plan.

Using function analysis and Function Analysis System Technique (FAST) diagramming, the team defined the basic function of this project as *Improve Safety*. Key secondary functions include *Separate Traffic, Accommodate Speed Differential,* and *Improve Sight Distance.* Analysis of the functions intended to be performed by the project helped the team focus on the purpose and need of the project and, consequently, how to craft alternative concepts that would provide the required functions.

Specific performance criteria were developed in cooperation with the designers and stakeholders. These criteria were weighted, using a paired comparison approach, and resulted in the criteria used to evaluate ideas and alternative concepts. These criteria are identified later in this section under the heading Performance and Value Improvement.

Approximately 60% of the estimated project costs are for earthwork and structural section work; almost half of those costs are contained in the Western section. Structures account for more than 20% of the project cost. Rising costs of asphalt and excavation work contribute significantly to the difference between the current project estimates and those contained in the original PSR documents.

Based on the current project estimates, the Highway User Benefit Cost Models show payback periods of seven years for the Western section, and five years for the Eastern section.

VA STUDY RESULTS

Five VA alternatives were accepted, resulting in cost savings of $29,800,000 and performance improvement of 19%. One of the accepted VA alternatives increased initial cost $2,300,000 but reduced highway user costs by approximately $29,700,000. The alternatives reduced the project's excavation quantities by almost 70%, reduced almost a mile of existing sustained 6% grade to 4%, eliminated an existing intersection at the bottom of a sustained grade, significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on/across the highway, and reduced construction time by at least one year. The use of the interchange in lieu of the intersection eliminates the only traffic signal within the project limits. It also reduces turning conflicts and should help to further reduce the accident rate in the area.

~~One additional VA alternative was conditionally accepted, which will result in additional savings of $6,000,000 when approved. This alternative will also further reduce excavation and right of way impacts.~~

Accepted Alternatives

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
1.2	**Realign SR 64 Southbound and Reroute Solitude Road**	$16,000,000	+3%
	This concept retains the 4% grade in the baseline design, reduces the design speed at horizontal and vertical curves from 130 km/h to 110 km/h, reduces the 18.6-meter median to 13.8 meters, and reroutes Solitude Road under the new Solitude Bridge to Wiley Road. This reduces right-of-way requirements, reduces environmental impacts, and improves local access in this section of the highway.		

Alt. No.	Description	Potential Savings Initial / *Highway User*	Performance Change
3.0	**Steepen Slopes to 1.5:1**	$6,000,000	+5%

This alternative results in cost savings, as well as a slight improvement in project performance. The concept reduces earthwork, decreases export, and decreases the amount of right-of-way required.

4.1	**Reduce Design Speed to 120 km/h in Selected Areas**	$6,000,000	+3%

This alternative recommends lowering the design speed to 120 km/h, or varying the speed to 120 km/h at Solitude, Continental, and Chandler Creek. The concept shortens the design radius of horizontal curves and shortens the length of vertical curves, as well as providing greater flexibility in design around obstructions and existing topography. Project performance would be slightly increased, and significant cost savings may be achieved.

5.0	**Go Around Oil Refinery; Realign Roadway to Intersect Utilities at 90°**	$1,000,000	+3%

This alternative alignment would place the highway further north to avoid the oil refinery pumping plant and cross the Chevron pipelines rather than overlap them. Although it adds right-of-way requirements, it significantly reduces the cost of relocating utilities and reduces environmental impacts to the riverbed south of the refinery.

8.0	**Undercrossing at Olive Hill Road with Interchange**	($2,300,000) *$29,700,000*	+15%

This alternative results in a significant improvement to traffic operations on the mainline by providing grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center, providing good access and visibility. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area. Significant Highway User Savings will result from this change.

~~**Conditionally Accepted Alternatives**~~

~~4.1~~	~~**Reduce Design Speed to 120 km/h in Selected Areas**~~	~~$6,800,000~~	~~+1%~~

~~This alternative recommends lowering the design speed to 120 km/h, or varying the speed to 120 km/h at Solitude, Continental, and Chandler Creek. The concept shortens the design radius of horizontal curves and shortens the length of vertical curves, as well as providing greater flexibility in design around obstructions and existing topography. Project performance would be slightly increased, and significant cost savings may be achieved.~~

~~The Project Manager has formally requested the design exception from Headquarters. Approval is expected by May 2002.~~

Rejected Alternatives

Alt. No.	Description	Reason for Rejection
1.1	Relocate/Consolidate/Improve At-Grade Intersections.	Rejected in favor of Alternative 1.2
1.3	Eliminate Wiley Drive Connection	Rejected in favor of Alternative 1.2
2.1	Design Median Width for Projected Traffic Volumes	Circumstances do not warrant a design exception for this change.
2.2	Reduce Solitude Grade Median to 7 Meters with Concrete Barrier for ~1,000 Meters	Maintenance would be more difficult, and the savings do not warrant sight distance problems that might be created.
4.2	Lower Design Speed to 110 km/hr in Selected Areas	Rejected in favor of Alternative 4.1.
6.1	Relocate 14/64 Interchange Beyond the Wetlands	Does not avoid all of the environmentally sensitive areas, and requires realignment of both SR 14 and SR 64.
6.2	Design Simple Flyover at the SR 14/SR 64 Interchange	Could necessitate realignment of both SR 14 and SR 64.
7.0	Eliminate Asphalt Treated Permeable Base and Edge Drains	Project does not meet the criteria for elimination of the edge drains.

PERFORMANCE AND VALUE IMPROVEMENTS

Performance measures are an integral part of the Caltrans VA process. It is important that they are well defined and agreed to by the stakeholders at the start of the VA Study, as they are used throughout the study to identify, evaluate, and document alternatives. They are also used to report performance and value improvements at the end of the VA Study.

When implementation decisions were concluded, the PDT evaluated the overall project with the accepted alternatives incorporated. Comparing the ratings, score, and value index for this group of alternatives to the baseline designs enabled the PDT to determine the relative improvements to the project that result from the VA alternatives.

The rationale for changes in performance and value of the accepted alternatives and the Performance Rating Matrix follow. More detail on the performance measures process is included in the VA Process Section.

Rating Rationale – Accepted Alternatives

Performance Criteria	Rationale
Mainline Operations	Improvement is primarily due to elimination of the only traffic signal on SR 64 within the project limits that resulted from converting the signalized intersection to an interchange.

Highway Safety Improvements	Addition of the interchange and elimination of turning movements into the commercial areas at this location will reduce the conflicts that have been the primary source of a number of accidents in this area. Reduced almost a mile of existing sustained 6% grade to 4%. Eliminated an existing intersection at the bottom of sustained grade. Significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on or across SR 64. Improved sight distance by using the Wiley Gardens intersection and a flatter curve.
Local Access	Elimination of traffic signal and replacing it with an interchange will improve the accessibility to the area where a new industrial park is planned.
Local Traffic Operations	Local access will be less convenient for High Valley residents. But other access should be slightly improved.
Constructibility	Reduction in excavation quantities of >2 million m^3. This is made possible by the reduction in design speed. The interchange at Olive Hill Road does not complicate construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impact	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation is avoided.
Right-of-Way	Significant reduction in the right-of-way requirements. Eliminates most building takes and reduces the need for new frontage roads.

~~In the event that any conditionally accepted alternatives are accepted at a later date, overall performance impact of the VA alternatives will be reevaluated.~~

PERFORMANCE RATING MATRIX - Accepted Alternatives ***Example Project - Project Close Out***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		Accepted Alts.									9		216
Highway User Safety	29	Original Concept						6					174
		Accepted Alts.									9		261
Access	19	Original Concept							7				133
		Accepted Alts.								8			152
Local Traffic Operations	10	Original Concept							7				70
		Accepted Alts.								8			80
Constructibility	2	Original Concept							7				14
		Accepted Alts.									9		18
Environmental Impacts	14	Original Concept						6					84
		Accepted Alts.									9		126
Right-of-Way Impacts	2	Original Concept					5						10
		Accepted Alts.									9		18

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
Accepted VA Alternatives (1.2, 3.0, 4.1, 5.0, 8.0)	871	29%	208.9	4.17	45%

VA STUDY SUMMARY REPORT TASK ORDER IDENTIFICATION	**Caltrans**
Project Name: *Example Project*	

TASK ORDER IDENTIFICATION INFORMATION

Contract	Task Order	District	County	Route	KP	EA
53A0020	115	13	NCA	64	51.8/80.8	3917U0
			NCA	64	80.8/90.0	39580K

STUDY TYPE

Highway	X	**Process**		**Product**	
NHS Mandated?	Y				

ANNUAL VA PROGRAM

Study listed on District VA Annual Program? (Y/N)	Y

KEY PROJECT MILESTONE DATES

M000	**Identify Need:**	June 1998	**M100**	**Approve DPR:**	December 2002
M010	**Approve PID:**	April 1999	**M200**	**PA&ED:**	October 2003
M015	**Program Project:**	July 1999	**M380**	**Project PS&E:**	March 2006
M020	**Begin Environmental:**	August 2000	**M500**	**Approve Contract:**	October 2006

PROJECT DESCRIPTION

The project will widen SR 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of SR 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. Phase 1 (Western section) is funded through construction, and Phase 2 (Eastern section) is funded through project approval. At Olive Hill Road there is a signalized intersection that will be upgraded with dual left-turn lanes from the mainline. The current estimate for the total project significantly exceeds available funding.

Capital Outlay Support Costs:	$2,640,000
Estimated Right of Way Cost:	$60,387,000
Estimated Project Construction Cost:	$172,534,000

PROJECT PURPOSE and NEED

The purpose of the project as stated in the Project Initiation Document is to increase capacity, reduce congestion, enhance safety, and improve level of service.

VA STUDY PURPOSE and OBJECTIVES

The VA Study will help create new alternatives and refine existing alternatives for the environmental document. By applying the VA process before the start of the technical studies, the environmental work will be better focused. The VA Study will comply with the Federal requirement for value analysis on NHS projects. The VA team will focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders. Specific issues the team should address include cut and fill balance within each segment, widening between the river and refinery, and the impact on the river, trucks turning crossing the median especially at the rest area, and the potential to replace the box culvert with a bridge structure.

VA STUDY SUMMARY REPORT PARTICIPANTS and SCHEDULE	Caltrans
Project Name: *Example Project*	

TEAM LEADERS				
Name	**Organization**	**Discipline/Position**	**Phone/Email**	**Expertise Level ***
Ginger Adams	Value Management Strategies, Inc.	Team Leader	(760) 555-3012	4
VA STUDY TEAM MEMBERS				
Terry Hodges	Caltrans	Traffic Operations	(855) 555-3664	4
Jeff West	Caltrans	Design	(855) 555-3393	4
Mary E. Campbell	Local Transportation Committee	Chairperson	(855) 555-2888	N/A
Meg Williams	City Representative	Planner	(855) 555-3970	N/A
Steve Dennison	Regional Transportation Agency	Planner	(855) 555-4662	N/A
Mike Ireland	Caltrans	Construction	(855) 555-3111	3
Wendy Weldon	Caltrans	Environmental Planning	(855) 555-3118	3
John Majors	Caltrans	Right-of-Way	(855) 555-3002	3
Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	(760) 555-3495	4
Mark Creveling	Simon Wong Engineering	Bridge Engineer	(760) 555-6844	3
PROJECT CONTACTS				
Tom Dallas	Caltrans	Project Engineer	(855) 555-3240	N/A
Wendy O'Mally	Caltrans	Design Manager	(855) 555-3681	N/A
TEAM RESOURCE ADVISORS				
Scott Williamson	Caltrans	Maintenance	(855) 555-3269	3
STUDY TECHNICAL REVIEWERS				
Larry Bonds	Caltrans – District 13	Environmental Planning	(855) 555-3801	4
Sherman Stallone	Caltrans – HQ	Senior Bridge Engineer	(855) 555-8248	4
Bruce Patton	Caltrans – District 13	Construction Engineer	(916) 555-9340	4
Alex Fitzgerald	Caltrans – HQ	Traffic	(916) 555-3838	4
PROJECT DECISION MAKERS				
Nevin Samuels	Caltrans – District 13	Traffic	(855) 555-	N/A
Kim Peterson	Caltrans – South Region	Project Development	(855) 555-0971	N/A
Jorge Granola	Caltrans – South Region	Chief - Design II	(855) 555-3860	N/A

VA STUDY SCHEDULE			
Meeting	**Dates**	**Times**	**Location**
Pre-Study Meeting	May 23, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 1	June 13-15, 2000	8:00 – 4:00	D-13 Conference Room
Study Briefing (Kick Off) Mtg.	June 13, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 2	June 20-22, 2000	8:00 – 4:00	Embassy Suites
Technical Review Session	June 21, 2000	1:00 – 3:00	Embassy Suites
Presentation (End of Segment 2)	June 21, 2000	1:00 – 3:00	Embassy Suites
Implementation Meeting	August 8-9, 2000	8:00 – 4:00	D-13 Conference Room

*** VA TEAM EXPERTISE LEVELS**

Since VA Studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be mid-level to expert-level in their knowledge, tenure, and overall experience in the referenced discipline. DVACs should contact the appropriate functional managers, well in advance of the study dates, to provide to the VA team individuals with this level of expertise, and begin recruiting for the VA teams. Consequently, DVACs will contact appropriate functional managers well in advance of the Pre-Study Meeting date to ensure the early recruitment of VA team members with the highest level of expertise.

Expertise Level
4- Expert
3- Advanced
2- Mid
1- Low

VA STUDY SUMMARY REPORT PROPOSED ALTERNATIVES	**Caltrans**
Project Name: *Example Project*	

Summary of *Proposed* VA Alternatives

VA Alternative Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.1	$885,000	$0	$0	$885,000	+3%
1.2	$16,183,000	$0	$0	$16,183,000	+3%
1.3	$1,700,000	$0	$0	$1,700,000	+8%
2.1	$5,097,000	$0	$0	$5,097,000	0%
2.2	$1,814,000	$0	$0	$1,814,000	0%
3.0	$6,420,000	$0	$0	$6,420,000	+5%
4.1	$6,409,000	$0	$0	$6,409,000	+3%
4.2	$9,853,000	$0	$0	$9,853,000	+1%
5.0	$1,011,000	$0	$0	$1,011,000	+3%
6.1	$400,000	$0	$0	$400,000	+2%
6.2	$4,006,000	$0	$0	$4,006,000	+4%
7.0	$3,170,000	$0	$0	$3,170,000	0%
8.0	($1,982,000)	($84,000)	$34,146,000	$32,080,000	+1.5%

Comments

Amount of savings estimated for Alternative 3.0 is ~$6,400,000. Actual savings could be as much as $12,000,000 to $13,000,000.

Summary of *Proposed* VA Alternatives - *Cumulative* Study Savings

VA Set No.	VA Alt. No.	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
1	1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0	$42,296,000	$0	$34,146,000	$74,376,000	+29%	+52%
		($1,982,000)	($84,000)	$0			
2	1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0	$45,740,000	$0	$34,146,000	$77,820,000	+24%	+52%
		($1,982,000)	($84,000)	$0			

Comments

Alternative 2.1 reduces median width to meet the expected road use - a divided highway, not an expressway.

Alternative 2.2 reduces the median width locally to reduce the impacts of large cuts.

VA STUDY SUMMARY REPORT ACCEPTED ALTERNATIVES	**Caltrans**
Project Name: *Example Project*	

Summary of *Accepted* VA Alternatives

VA Alternative Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.2	$16,000,000	$0	$0	$16,000,000	+3%
3.0	$6,000,000	$0	$0	$6,000,000	+5%
4.1	$6,000,000	$0	$0	$6,000,000	+3%
5.0	$1,000,000	$0	$0	$1,000,000	+3%
8.0	($2,300,000)	($84,000)	$29,700,000	$29,800,000	+15%

Comments

Reduction in performance for alternative 1.2 is due to removal of one local access point.

The validated savings have been reduced from the proposed $6,409,000 to $6,000,000.

Summary of *Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Perf.	Change in Value
1.2, 3.0, 4.1 5.0, 8.0	$29,800,000	$0	$29,700,000	$57,116,000	+29%	+45%
	($2,300,000)	($84,000)	$0			

Comments

*Indicates Set Used in Report Calculations.

VA STUDY SUMMARY REPORT BENEFIT SUMMARY	Caltrans
Project Name: *Example Project*	

Cost of Performing VA Study	
Caltrans Administrative Costs	$14,400
In-House Team Members	$21,450
Consultant Team Leader	$45,530
Consultant Team Members	$11,620
Total Study Costs	$93,000

Summary of VA Study Benefits	
Accepted Implementation Rate (Accepted / Accepted + CA)	62.5%
Cost Reduction, Expressed as a Percentage Accepted /Accepted + CA)	13%
Study Return on Investment (ROI) (Accepted / Accepted + CA) **Implemented Savings Divided by Study Costs (Stated as xx:1)**	319:1
Study Value Return on Investment (VROI) (Accepted / Accepted + CA) **(Value Improvement x 1,000,000) divided by Study Costs (Stated as xx:1)**	462:1
Project Delivery Time Saved (Months)	12
Project Capital Outlay Support Costs Saved ($)	($70,000)

Summary of Study Impacts

Implemented VA alternatives reduced the project's excavation quantities by over 70%, reduced almost a mile of existing sustained 6% grade to 4%, and eliminated an existing intersection at the bottom of a sustained grade. The alternatives also significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt during construction. Construction time was reduced by at least one year. The new interchange will eliminate the only traffic signal along the corridor, which will help to improve operations. The interchange will reduce turning conflicts in an area that has historically had a very high accident rate. It will also reduce a bottleneck along the route that will result in improving operations as traffic demands increase. The relationship between Caltrans and the local stakeholders (Regional Transportation Agency, City & Community Groups) were strengthened as they used the VA process to work together to address and resolve project concerns to the benefit of all. The five accepted VA alternatives result in cost savings of $29,800,000, performance improvement of 19%, and value improvement of 43%. One of the accepted VA alternatives increased initial cost $2,300,000 but reduced highway user costs by approximately $29,700,000.

VA Study Timing Impacts – General Comments

The VA Study was conducted early in the Project Approval Document Phase, before the detailed Environmental Technical Studies started. This provided the VA team maximum flexibility to develop alternatives to improve the project. There were no alternatives rejected due to timing.

VA Alternatives Rejected Due to VA Study Timing

Alternative	Reason
None	

Value Analysis Report Guide

Third Edition

April 2003


Caltrans